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The Impact of Individual- and Contextual-Level Characteristics on the Health of Metropolitan Seoul Adult Residents

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The Impact of Individual- and Contextual-Level Characteristics on the Health of Metropolitan Seoul Adult Residents

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Dedication

To my parents, Dae-hyun Cho and Jong-sook Woo, for the great respect and love they have taught me for myself and for mankind.

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The Impact of Individual- and Contextual-Level Characteristics on the Health of Metropolitan Seoul Adult Residents

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This project examines contemporary health status of Metropolitan Seoul adult residents from a sociological point of view. Recent changes in the pattern of urbanization observed in Metropolitan Seoul include intra-urban population redistribution, which also involves residential clustering by socioeconomic status. This process results in uneven distribution of social resources and quality of life across small areas within Metropolitan Seoul. This project investigates the impact of ecological characteristics, such as area-level socioeconomic status, public/private organizational aspects, and environmental hazards, on the health of adult individuals in this area. Responding to the fact that there have been few attempts to examine the health of Koreans focusing on social risk factors, this project also takes into account individual-level demographic and socioeconomic characteristics with respect to their effects in shaping unequal distribution of

health and illness in Metropolitan Seoul. Findings based on three health outcomes (daily activity limitations, chronic illness status, and self-rate health status) indicate that adverse health among this population is highly associated with low level of individual-level socioeconomic status. In particular, individuals with very low educational attainment are at high risks of activity limitation and chronic disease, which reflects the importance of education in Korean society. Being inconsistent with findings from similar studies in Western societies, area-level attributes show little or none effect on the health of individuals. Findings from the analysis of the pattern of health care service utilization among Metropolitan Seoul residents suggest that public health policy should be prepared in the direction that attracts individuals of low socioeconomic status to pay particular attention to prevention of diseases.

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CHAPTER 1: INTRODUCTION

Since the 1960s, Korea has undergone a rapid industrialization process, which has brought substantial economic growth throughout the country, and as a result, the overall standard of living has also notably improved. Despite this, it is reported that inequality across social classes and regions has significantly expanded in Korean society (Kim 1994). Regional inequality was observable primarily between urban and rural areas during the period of rapid industrialization. That is, material and human resources were concentrated in a few urban centers, leaving other regions, particularly rural areas, in a situation of economic disadvantage and even exploitation. As a result, those urban centers, or prime cities, continuously received most of the advantages from development, which reinforced the migration of rural population to the cities. In particular, the development of Seoul, the capital city of Korea, was rapid, and about 1.73 million people were added to the population in the 1966-70 time period – a figure which was 77% of national population growth. Although the population growth of Seoul decreased in the period from the mid-1970s to the early 1980s, there was an enormous increase in population at the periphery of Seoul, resulting in a large urban network, referred to as Metropolitan Seoul (Kwon, Kim, and Choi 1995).

The growth of peripheral areas of Seoul was initiated by the government policy to reduce concentration of population and resources in Seoul. Although the policy was intended to implement the equal redistribution of population and resources throughout the nation, it actually resulted in the pathological growth of Seoul and its surrounded areas. Since manufacturing industries had to locate physically near Seoul for administrative and other practical purposes, they chose to relocate themselves in towns near Seoul, which in turn pulled more population from rural areas. Even though there were other cities that experienced growth of population and economic capacity (such as Pusan and Daegu), their growth was not comparable to that of Metropolitan Seoul. Indeed, about 43% of Korean population was concentrated in Metropolitan Seoul area in 1990, and the recent population and housing census revealed that 46.3% of entire Korean population resided in this area in 2000 (National Statistical Office).

Since the mid-1980s, the pattern of population movement and regional inequality has become diversified in a manner that goes beyond the simple urban versus rural dichotomy since the mid-1980s. Recently, population movement from rural to urban areas, especially to Metropolitan Seoul, has notably decreased in its size and rate (Choi 1997). Rather, Metropolitan Seoul began to experience a wide range of intra-urban population movement. That is, residential areas in the city developed along the lines of residential conditions and real estate values.

Population moved from one location to another within Metropolitan Seoul according to their socioeconomic status. This pattern of intra-urban population movement was first initiated by the construction of apartment complexes in areas that were formerly paddy ground. Since these new residential developments afforded higher residential quality (at higher prices) compared to many other residential areas in Seoul, movement into these areas tended to be selective of the more affluent (Choi 1994). Continuous movement of the affluent searching for better living conditions and/or real estate investment opportunities was given additional impetus in the mid-1990s by the construction of new towns at the out-skirts of Seoul (Yoon 1998; Cho 1999). As might be expected, these new towns serve primarily a residential function, with residents commuting inward in order to maintain their economic activities in or near the core. Thus, the pattern of population movement in Korea during last four decades can be characterized in the following two ways, (1) the massive rural to urban, specially to Seoul, population movement in the period of 1960 to mid-1980s, and (2) the decrease of the rural population influx to Seoul and the increase of intra-urban population redistribution.

The implication of population dynamics described so far is that it involves the pattern of distribution of wealth and poverty in the nation. Douglas Massey's (1996) presidential address to the Population Association of America in 1996

provides very useful insights into the spatial distribution of poverty and affluence vis-à-vis the relationship between the ecology of population movement and development. He argued that wealth and poverty were spatially concentrated along rural and urban lines during the period of industrialization. The advent of postindustrialization throughout the world since the 1970s, however, modified the pattern of spatial concentration of wealth and poverty. That is, residential clustering by socioeconomic status of residents would more and more take place in urban centers, mirroring the earlier pattern of urban-rural division of wealth and poverty. Poverty would be more concentrated in certain parts of the cities in the later period through an ongoing process of urbanization, which would lead to a different level and quality of social services and infrastructure within cities. Further, the spatial concentration of poverty would create a harsh and destructive perpetuation of polarized norms, attitudes, and behaviors of the residents. Further, due to the different level of education by residential clusters, the chances of social mobility can be expected to decrease, crystallizing social classes in the new century. Although Massey's view led to considerable debate (see, Danziger 1996; Farley 1996; Hout et al. 1996), it seems certain that residential clustering by socioeconomic status will increasingly be a prominent factor influencing quality of life in cities of both developed and developing countries.

The patterns of urbanization and population movement in Metropolitan Seoul, as described above, are rather consistent with Massey's argument. During the period of rapid industrialization, benefits from economic growth were concentrated in urban areas, particularly in Seoul. The wave of rural population that moved to Seoul in early years tended to lack the experiences and resources to secure promising employment, which made it very difficult for those migrants to achieve upward social mobility. Since then, poverty has concentrated within Seoul, and with the construction of apartment complexes and of the new towns at the outskirts of Metropolitan Seoul, population has been redistributed according to their socioeconomic status.

It has long been a tenet of sociological urban ecology that the socio-spatial distribution of population reflects hierarchical structures that include unequal distribution of social resources which, in turn, make for inequalities in quality of life (Fossett and Cready 1998; Hawley 1971; Massey and Eggers 1990). Among the most fundamental dimensions of quality of life is health status. The fact that the quality of life varies significantly from area to area implies the possibility of regional variations in health status. Previous research indicates that ecological or contextual characteristics, as well as the attributes of individuals may, play an important role in variation in health across areas (Humphreys and Carr-Hill 1991; Curtis and Jones 1998; Frohlich, Corin, and Potvin 2001). That is, past and

current spatial distribution of population and wealth in Korea may result in an unequal distribution of social resources and quality of life, which affects the health of Koreans, bringing about the unequal distribution of health and illness across areas in Korea. To illustrate, during the period from the 1960s to the mid-1980s, when Korea was involved in rapid industrialization process, there were differences in the general status of health between rural and urban areas as the result of spatial differentials of the benefits from economic growth. Since the mid-1980s, however, the variations in health across areas may have been more evident within cities, as with the recent pattern of population redistribution by SES in Metropolitan Seoul. Compared to the amount of research on the past experience of population dynamics (rural vs. urban), the evolving patterns of current urbanization and population redistribution by SES in Metropolitan Seoul have been the subject of little research, despite of the fact that close to half of entire Korean population resides in the area. In particular, there have rarely been studies that examine the health of Metropolitan Seoul residents with regard to the recent patterns of spatial distribution of wealth and poverty that may have important effects on the differentials in the contextual characteristics across areas.

Therefore, the large agenda of this dissertation is to explain contemporary health of Metropolitan Seoul residents, but particular attention is paid to the spatial pattern of distribution of health and illness. The agenda also includes

examining the health of this population from a sociological point of view which emphasizes the roles of sociodemographic and/or socioeconomic characteristics of individuals and of socio-environmental characteristics of areas in shaping health outcomes. Based on this research agenda, this project has the following aims: (1) to investigate which, and to what extent, individual-level demographic and/or SES risk factors have an impact on the health of Metropolitan Seoul adult residents; (2) to document which, and to what extent, contextual characteristics have effects on the health of individuals; and (3) to detect whether or not there are variations in health across small areas in Metropolitan Seoul, employing the multivel analysis techniques. Once accomplished, these aims can be expanded to suggest public health policy implications. Although the research agenda for this dissertation was initiated by the emerging patterns of population redistribution and concentration of wealth and poverty and their contextual impact on the health of Koreans, I place equal emphasis on the social risk factors of individuals throughout this research, because there have been few attempts to investigate the health of Metropolitan Seoul residents which take into considerations of a wide range of sociodemographic and socioeconomic characteristics of individuals, based on a nationally representative data set.

This dissertation is composed of nine chapters including this introduction (Chapter 1). In Chapter 2, I review the previous literature on health in Korea and

on ecological approaches to health issues, generating a conceptual model to analyze the contemporary health issues of Koreans. Data and methods used for this project are introduced in Chapter 3. There, I discuss units of analysis, variables, how the final data set for the dissertation is constructed, and what statistical methods are utilized to test hypotheses. Chapter 4 is devoted to the research design and research questions in this project. In Chapter 5 through chapter 8, I examine the findings and analyze the results for four dimensions of health employed as dependent variables: activity limitation status, chronic disease status, and self-rated global health status, and annual hospitalization days, respectively. Lastly, Chapter 9 reflects an attempt to synthesize overall findings and analyses. I conclude by suggesting policy implications for Korean health, based on the findings of this project.

CHAPTER 2: CONCEPTUAL AND EMPIRICAL MODELS FOR THE HEALTH AND CONTEXTUAL CHARACTERISTICS

1. CONTEXT, INDIVIDUALS AND HEALTH

In this section, I review previous studies on the health of Koreans. Since the health of Koreans has been the subject of little research outside Korea, my review of previous studies is mainly carried out based on literature published in Korea. Then, I introduce a conceptual background for the discussions of the relationship between contexts and individuals with respect to the health of individuals.

A. Area Variations in Health Status in Korea

As already noted, although the overall quality of living has greatly increased in Korea over the past four decades, inequality across areas still remains, and in recent years, the pattern of spatial distribution of wealth and poverty has become more complicated and pronounced than ever before. Clear differentials in

the quality of living across areas have led researchers to pay attention to their consequences, in particular the differentials in health status (Oh 1999). Most Korean studies have focused on the differences in health status between urban and rural areas. For instance, Min and Oh (1999) compare the health status and health behaviors between urban residents and rural residents, and find that rural residents have inferior health compared to their urban counterparts, which is attributed to differences in health behaviors. While urban residents are more likely to be concerned about their health, rural residents tend to smoke more, exercise less, and have less concern about obesity than urban residents. Another study also finds that, among the elderly population, urban residents are more likely to have religious affiliations, be employed, reside in an extended family, and have regular exercise habits than do rural residents. These patterns also result in worse health among the rural elderly population, in comparison to the urban elderly (Kang and Shin 1996). This rural disadvantage also applies to child populations. According to a recent study (Lee, Yoo, and Chung 1997), urban children have higher weight and height for age than do the rural children, indicating better nutrition status of the former. This study also shows that elementary school students residing in rural areas tend to have worse dental health tan their urban counterparts

Regional inequality is not just limited to overall health status. The provision and utilization of health services also show rural-urban variations.

Although most studies have indicated worse health status in rural areas, there are a few studies that have reported relative advantage of rural areas over urban areas, in terms of the levels of health care provision and utilization. In Korea, the national medical insurance system was instituted first for rural populations in 1988, followed by inclusion of urban residents in 1990 (National Health Insurance Corporation). Further, government's investment in public health policy has been heavily concentrated in rural areas, enhancing primary health care for the rural populations through construction of health centers, health sub-centers, and nurse practitioner's posts (Joo et al. 1996). Due to these government efforts, recent statistics show that the level of utilization of medical care services is higher in rural than in urban areas (Kim 1991). However, one study adduces evidence that there is no statistical difference between rural and urban areas in the utilization of medical services (Oh 1999). Overall, these findings suggest that rural residents have better access to health care, and are more likely to utilize medical services, than their urban counterparts. This pattern is mainly due to earlier initiation of the medical insurance system in rural areas and to the government's effort to decrease rural/urban inequality.

However, other studies argue that more favorable rural health care is no more than an artifact. Joo et al. (1996) examine the level of utilization of medical services and find that the greater use in rural areas, in terms of number of

physician visits and the number of hospital admissions, disappears when variables indicating medical need and supply are controlled. They suggest that rural areas are increasingly isolated with large elderly populations, lower levels of education, and lower levels of income. Once the quality of medical service and the need for specific medical service are considered jointly, rural areas are significantly disadvantaged compared to urban areas, in spite of the government's effort to enhance rural primary health care. Oh (1999) finds similar evidence that rural areas have less access to outpatient health services than is the case in urban areas. He reports that pharmacy visits should be taken into account when access to health services is compared between regions. Koreans tend to turn first to pharmacies for medical care for minor illnesses, instead of visiting doctors, and there are fewer pharmacies in rural areas compared to city areas. Rural residents visit health centers and health sub-centers, while their urban counterparts rely more on pharmacies, for minor illness. It is important to note that visits to health centers and health sub-centers are counted as utilization of health services, while pharmacy visits are not. Adjusted for pharmacy visits, this study shows that the quantity of health services and utilization of them are notably lower in rural then in urban areas (Oh 1999).

Although these studies have expanded the depth and breadth of understanding of regional inequality of health and health care services in Korea,

most of them focus on the diffentials between the rural and urban areas. As already discussed, recent dynamics of population redistribution imply that geographical inequality in Korea has become more complex, which in turn suggests the possibility of polarized health status across sub-areas of Metropolitan Seoul. The fact that most prior research has addressed rural-urban differences, coupled with evidences of growing intra-metropolitan inequality, provides a strong rationale for a focus on Metropolitan Seoul. That is, geographical variation of health status now includes more than just the urban versus rural dichotomy. It is also necessary to consider intra-urban and/or intra-rural variations in health status. Indeed, a recent study shows evidence of local level variations in health status among children (Lee et al. 2000). This research examines the susceptibility to respiratory disease of children living in a mid-size city called Ulsan, and finds an unequal probability of contracting respiratory disease across small areas in the city, which is associated with varying air quality. Another study compares the health of urban poverty area residents with that of rural areas (Lee et al. 1998), highlighting the current situation of health status and services for urban squatter settlements. It suggests that people in urban poverty areas are facing more devastating health-related conditions than any other population in the country. While the government public health program is concentrated on the improvement of well-being for rural areas, poverty areas in the city have been alienated from

the development of medical services. This study discovered that poverty area residents in a city tend to be elderly, to disregard illness or symptoms, and to underutilize medical relief programs. Although urban residents have better access to medical facilities, in terms of time and distance, and the overall social environments are not as hazardous (i.e., water and sewage services), compared to their rural counterparts, they make less use of medical services not only due to economic constraints but also to the lack of available public health services. As reflected in these two studies, intra-area disparities of health status have expanded in recent years, and poverty is concentrated in urban areas, leading resident to be disadvantaged both by their low socioeconomic status and by low levels of pubic support.

Thus, previous studies of the health of Koreans have been successful in uncovering regional variations of health status as well as levels of health services. However, they are limited in at least the following two ways. First, few studies have been based on national-level data. Local level studies are important in that they can provide unique evidence of residential inequality within local areas, but it is difficult to generalize to the national level from local level research. Although this project focuses only on the Metropolitan Seoul residents, it goes over and beyond the previous research, because Metropolitan Seoul represents about half of the Korean population, and the recent dynamics of population

redistribution is evident in the area. To uncover *general* relationships between contextual characteristics of areas and individual health, it is necessary to view these relationships from a national perspective. Second, most previous studies are descriptive. They rarely utilize multivariate analyses, and thus fail to investigate relationships between sociodemographic and/or socioeconomic risk factors and health status for Koreans. For instance, Kim (2000) examines the health and nutrition status of Koreans with regard to the effects of sociodemographic and socioeconomic risk factors, utilizing a recently created data set from nationally representative samples (indeed, he uses the 1998 Korea National Health and Nutrition Survey - one of the data sets employed in this dissertation, see Chapter 3 for details of 1998 KNHNS). Although his study generates extensive findings on the relationship between social risk factors and health and nutrition status of Koreans, these findings are based only on descriptive analyses. It does not estimate the net effect of sociodemographic or socioeconomic risk factors on health and nutrition outcomes, and does not investigate the pathways through which these effects operate.

B. Context and Individual Health

There has been a long history of studying the health of individuals, utilizing only individual characteristics as risk factors for susceptibility to morbidity and mortality. Perhaps one reason for this is the growing importance of

degenerative and chronic diseases since the 20th century, and these diseases have been known to be more associated with behavioral and biological risk factors of individuals (Diez-Roux 1998). However, more recently, much attention has been paid to the effect of the environment, both natural and social on the health of individuals. That is, although we have learned much from studies of micro-level influences on health, research conducted exclusively at the individual level disregards the importance of geographic, community, and/or neighborhood influences in shaping one's health status (Susser 1994). Indeed, a burgeoning number of recent studies have indicated the importance of the effects of contextual variables on individual health and variations in health across areas (Humphreys and Carr-Hill 1991; Curtis and Jones 1998; Frohlich, Corin, and Potvin 2001; Diez-Roux 1998, 2001).

To understand the health of individuals based on the relationship between individuals and their environments has long been central to the sociological approach (Duncan, Jones, and Moon 1996). At least since Durkheim's work (1964: 1897), it has been a major analytic concept in sociology that social structures, as "social facts", exist and ought to be conceived as independent of individuals. Further, both early and contemporary social ecology has focused on the ecological/contextual formation of society, which was envisaged in the term "POET" (population, organization, environment, and technology) (see, Micklin

and Sly 1998). What is important for present purposes from the legacy of Durkheim in sociology and social ecology is the conceptualization of a social context as more than sum of individuals living in it. Rather, an ecological unit or community includes a patterned regularity that affects the life of its residents. The patterned regularity is not simply the geographic location, but features including socioeconomic status, public services, aggregated behavior, and culture (Yen and Syme 1999). Recently a number of studies have emphasized the role of contextual characteristics for infant and adult health and health behaviors. Fang et al. (1998) found that the level of residential segregation was negatively and independently associated with adult mortality in the US cities. Finch, Vega, and Kolody (2001) examined the relationship between neighborhood characteristics and substance use during pregnancy for California residents. They found that the level of neighborhood public assistance had a significant effect on substance use, independent of individual sociodemographic and SES risk factors. Waitzman and Smith (1998) reported that poverty-area residence was associated with an elevated risk of adult mortality in the US, net of individual risk factors. Another study based on US data found an association between female-headed household rates for neighborhoods and women's risk of heart disease mortality in the US, even with relevant individual level controls (LeClere, Rogers, and Peters 1997). Duncan, Jones, and Moon (1999) studied the association between individuals'

smoking habits and the level of area deprivation in the UK, finding a "social miasma" effect of deprivation. They found that collective group properties exerted some influence over and above individual properties. Jenny et al. (2001) documented that community contexts, particularly the degree of Hispanic culture in a community as measured by the proportion of Hispanic population, was a significant risk factor for infant mortality among Mexican Americans. Recently, Geronimus et al. (2001) demonstrated that differences in life expectancy, functional status, and active life expectancy between the black and white populations in the US were significantly associated with rural/urban residence and community SES. In the UK, Jones and Duncan (1995) found that chronic illness of individuals was not the outcome of individual characteristics only; rather socio-structural characteristics had fairly large and statistically significant effects. A recent study conducted in Finland reported that socio-regional context (level of services, occupational structure and self-sufficiency of employment) was associated with adolescents' alcohol use (Karvonen and Rimpela 1996). Malmstrom, Sundquist, and Johansson (1999) reported similar results regarding the association between neighborhood SES and self-rated health status of individuals in Sweden.

Thus, it is clear that the interest in how contextual characteristics impact the health of individuals has increased notably in recent years. In spite of this

growing interest, the understanding of how place may interact with individual health or with area variations in health is far from complete (Curtis and Jones 1998; Diez-Roux 2002). In a sense, whether to emphasize the role of context or the role of individual characteristics on health outcomes does have to do with the well-known dilemma of macro- versus micro-approaches in sociology. Indeed, a recent study by Frohlich and her colleagues (2001) performed a theoretical examination of the relationship between context and diseases, utilizing Giddens' structuration theory and Bourdieu's notion of *habitus*. According to the authors, Giddens represents the microscopic tradition, while Bourdieu represents the macroscopic tradition. According to structuration theory, there is not uni-directionality between structure (context) and agency (individual), and structure does not exist outside the knowledge of agents, because agencies are conscious individuals rather than subordinating creature to social context (Giddens 1984). On the other hand, Bourdieu (1984) is concerned with the autonomous role of *habitus* that relates structure (context) to agency (individual). Habitus is a system of "structured and structuring dispositions" of a cognitive sense. Individual actors tend to internalize the objective regulations emanating from social institutions such as law enforcement, family, and culture, formulating *habitus*, which in turn, orients and shapes all manifestations of individual acts. According to the interpretation of Frohlich and her colleagues (2001), Giddens' structuration theory

can be understood as continuum of the tradition of microscopic perspectives, while Bourdieu's notion of *habitus* stays on the side of macroscopic perspectives. Regarding the relationship between context and individuals vis-à-vis health outcomes, I propose that the structuration theory by Giddens and the notion of *habitus* by Bourdieu provide general theoretical frameworks which are complementary rather than competing. Even though Giddens emphasized the role of the knowledge of agent toward external stimuli, he believed that knowledge would be influenced by time and space, which he thought of as important aspects of structure, and thus the relationship between structure, knowledge, agency, and action is a complex set of interactions. For instance, if one is sick, whether or not the person seeks medical treatment would be dependent on personal decisions based partly on one's knowledge of the availability of medical facilities. Thus, one's knowledge plays an important role here, but action is influenced by structure. In the case of Bourdieu, *habitus* mediates between the structure and the act of agency. Although the formulation of *habitus* is mainly determined by structure, still it is a system of cognition which belongs to agency. How one self-identifies one's health status would be determined by the cognition of his/her social position and status, which are meaningful within the boundary of social structure. Therefore, synthesizing the structuration theory by Giddens and the notion of *habitus* by Bourdieu, it is not hard to conclude that the relationship between

context and health and between individual and health are both important for a substantial understanding of health outcomes. This provides am appropriate general background for an approach that looks at the pattern of distribution of health and illness among a population taking into account both individual- and macro-level risk factors simultaneously.

2. MODEL CONCEPTUALIZATION

The basic analytic framework utilized in this project simultaneously takes into account individual- and macro-level risk factors. This makes it possible to investigate the impact of individual risk factors within specific contextual environments which may alter individual effects on health outcomes. That is, the individual characteristics and processes influencing individual health may operate differently in different social structures. The rationale for the contextual variables included in this analysis derives from research indicating that low SES communities are likely to be disadvantaged in a number of ways that are deleterious for the health of individual residents. Robert (1999) suggests that social conditions, adequacy of services, and the physical environment are apt to be substandard in poorer areas. For example, low SES communities are more

likely to suffer in terms of both the quantity and quality of municipal and public health services. Such communities may have a low level of social capital and be socially isolated, and thus may acquire values and norms that negatively affect health. Further, low SES areas may have physical environments characterized by higher levels of air, water, and/or noise pollution. Curtis and Jones (1998) address the disadvantage of living in low SES communities on health by classifying the community context into three categories: Materialist landscapes, landscapes of consumption, and ecological landscapes. Materialist landscapes include housing conditions and employment opportunities. Poor housing conditions increase the chance of exposure to disease, and concentration of unemployment in a community may lead to fatalistic views among its residents. Landscapes of consumption involve poor health facilities, poor retail outlets for food, and lack of leisure facilities. Since medical practitioners tend to locate themselves where financially secure patients are prevalent, individuals in the poverty community may lack the proper access to health care facilities. Quality and even supply of food may be substandard in poverty areas. Hazardous environments may be directly threatening to health and also curtail leisure activities that might otherwise promote good health. Ecological landscapes include pollution due to noxious emissions, and poor cleansing of public spaces. It is obvious that pollution generating facilities elevate the exposure to the

environmental hazards for the community. Thus, various contextual conditions of deprived areas may exacerbate the health problems of residents whose low SES has already elevated the risk of adverse health outcomes.

Yen and Syme (1999) examine how individual and contextual risk factors affect health. Reviewing a wide range of literature on urban ecology, they address two dimensions of context. One dimension involves social structures that denote discrimination and income inequality. Especially in US society, discrimination and racial segregation have been found to be significantly associated with adverse health consequences. A high level of income inequality may result in low level of social trust and social capital, which, in turn, have deleterious health effects. The other dimension is the quality of environment. This term refers to social and natural environments of neighborhood or community as reflected by crime rates, local resources, and social cohesiveness. Persons who live in a community where the quality of environment is low are more likely to engage in adverse health-related behaviors. In an earlier study, Macintyre, Maciver, and Soomans (1993) delineate five aspects of the physical, social, and cultural environment that may promote or damage health of individuals. The five aspects are: (1) physical features shared by all residents, (2) the availability of healthy/unhealthy environments that include conditions of housing, employment, or recreational facilities, (3) services provided to support

the daily lives of residents, (4) socio-cultural features of the community, and (5) the reputation of the community. According to the authors, these five factors have an impact on the health of individuals not only directly, but also indirectly, from the interactions between each of these five aspects of community environments. Another type of interaction between these aspects of community and individual attributes may cause the effects of individual attributes on health to be variable across communities. For instance, a leisure facility (e.g., a golf course) may promote the health of individuals who often utilize it, while it may work as a mental stressor for those who cannot afford to enjoy the facility. Another study, on neighborhood poverty vis-à-vis the health of children, develops a conceptual framework of the contextual implication for individual health based on a structural-ecological approach (Aber, Gephart, Brooks-Gunn, and Connel 1997). In work reminiscent of Massey's "Age of Extremes", Aber an her colleagues suggest that "globalization, economic restructuring, migration, and various public policies at the federal and local levels have led to… increases in the geographic concentration of poverty. (1997: 52)" The geographic concentration of poverty determines the features of the neighborhood or community context, and the features include structural and compositional characteristics, social organization, and cultural processes. Physical environments, community SES, age and sex composition, residential stability, housing density,

institutional resources, etc. (structural and compositional features) have direct or indirect effects on the health of individuals. Participation in the community organizations and maintaining informal social networks (features of social organization) promote social cohesion not only in the neighborhood or community but also in the family, which might promote mental and psychological health. Further, all these characteristics affect the clarity and consensus about community values and norms (features of cultural process), which may fundamentally affect health related attitudes and behaviors.

Thus, many studies have constructed conceptual frameworks to explain how contextual risk factors of a community affect the health of its residents. In spite of different terminology, there is a great deal of similarity in the basic ideas imbedded in these studies. That is, the aspects of contexts believed to have an impact on the health of community residents are largely overlapping across studies. In this dissertation, I focus on three contextual characteristics that may affect the health of adult residents of Metropolitan Seoul: Area level SES, public/organizational aspects, and structural aspects. Area level SES includes compositional and ecological well-being of an area. That is, an area can be affluent or poor as reflected in composition of residents' SES or in terms of property values. Public/organizational aspects involve the effort of public/private organizations to promote the health of residents. For instance, larger public

expenditures by a local government make available better and more accessible public health care facilities may improve the general health of community residents. Structural aspects include the natural and man-made environments that may increase or reduce the risk of adverse health outcomes for community residents. Pollution generating facilities are an example of this. Of particular interest is that these three aspects are interdependent, and their effects on the health of individuals may be altered by the interaction with the effects of individual characteristics.

Now I describe the mechanisms through which the contextual attributes and individual attributes are related, with respect to their impact on the health of individuals and on variations of health across areas. There are basically four properties that have to be included in a model: individual-level health outcome (y), individual-level risk factors (x), area variations in health outcome (Y), and area-level risk factors (X). To incorporate these four properties into one model is not a simple task in terms of statistical application and model conceptualization. Here, I account for the conceptual pathways relating these four properties. The statistical technique appropriate to the conceptual model is discussed in Chapter 3.

If only individual-level properties are taken into account, the model can be rather simple. As an explanatory variable, individual-level characteristics (x) influence the risk of individuals' health outcome (y). This represents the

conceptual model of conventional approaches on which most previous studies have been based. As I discussed, health of an individual is also deemed to be influenced by social contexts that surround him/her. A number of previous studies have adduced evidence of an independent effect of contextual variables (X) on the health of individuals (e.g., Duncan et al. 1993; Hart, Ecob, and Davey 1997; Humphrey and Carr-Hill 1991; Boyle and Willms 1999; Balfour and Kaplan 2001). However, other research reports that the contextual effect becomes small, or disappears entirely, when individual-level factors are taken into account (e.g., Sloggett and Joshi 1994; Robert 1999; Yen and Syme 1999). The latter findings may suggest that the effects of contextual risk factors on the health of individuals are mediated by individual-level risk factors. On the other hand, it is also possible to postulate that the effect of individual-level risk factors on individual health outcomes are dependent of contextual characteristics. For instance, the effect of low family income (e.g., lower than the official poverty line) with regard to the outcomes may be different in an affluent neighborhood than in a neighborhood that is itself a poverty area (e.g., Yen and Kaplan 1998,1999). Therefore, the conceptual model should at least allow for the interaction of individual-level risk factors and macro-level risk factors, which is congruent with the aforementioned theoretical discussions on the relationship between structure and agency.

Lastly, we can add area variations in health outcome (Y) in the model. The property Y is a response variable, just as individual health outcome *y*. But unlike *y*, Y is an attribute of area; the value of which can be calculated by aggregating *y*s in the area. This means that Y is a compositional outcome of *y*. That is, *x* and X explains the *y*, and in turn, its composition (Y) can be accounted for. Of interest is that both individual health (*y*) and the variations in health across areas (Y) are explained by individual- and contextual-level risk factors. Hence, the basic analytic framework of my dissertation is comprised of individual- and area-level risk factors and individual- and area-level health outcomes.

CHAPTER 3: VARIABLES, DATA, AND METHODS

In this chapter, I introduce variables, data, and methods utilized in the main analyses in this dissertation. Both dependent and independent variables are operationally defined and the rationale for including each variable is discussed here. In the data section, I provide detailed information on the data sets used in the analysis. This section is followed by a discussion of the statistical methods, where I explore the random effect multilevel regression analysis technique. I begin with a discussion on the unit of analysis.

1. UNIT OF ANALYSIS

The general purpose of this dissertation is to investigate the health of Metropolitan Seoul adult residents as well as the area variations, taking into account the impact of both individual and contextual risk factors simultaneously. To accomplish the purpose systematically, I introduced the conceptual model in Chapter 2; the model that includes four properties that can be classified into two categories. That is, individual-level risk factors (x) as well as health of individuals (y) obviously attach to the micro unit, while area-level contextual characteristics (X) and the area variations in health (Y) are involved in the macro

unit. Accordingly, there are two levels of analysis in this project, and the following discussions in this chapter make reference to the micro- (individual) and macro- (area) units.

The contextual (area) variables are more than just a framework for identifying patterns or a means of deriving areal surrogates for individual data which are not readily available. Many relevant studies have used aggregate data as both dependent and independent variables. Although aggregate results may indicate the role of ecological effects on the geographic variations in health status, they do not necessarily mean that relationships hold at the individual level. In other words, outcomes from aggregate data cannot reveal the interaction effects between the macro variables and individual risk factors. Also, one risks the "ecological fallacy" by trying to generalize from aggregates to individuals (Robinson 1950). In contrast, to draw inferences about the macro level based on individual level data would lead to what has been called the "atomistic fallacy" (Alker 1969). Jones and Duncan (1995: 28) point out that "researching exclusively at the individual level misses the context in which individual action occurs." Therefore, as mentioned earlier, it is more appropriate to take into account both micro- and macro-level risk factors in studying the health of individuals as well as area variations in health.

The meaning of individuals as the unit of analysis is clear and requires no elaboration. However, in the case of macro-level, area must be precisely defined, because it is likely that the extent of contextual variation is dependent upon the boundary of an area (Bolye and Willms 1999). The macro-level in this project is the jurisdictional area, set according to administrative purposes. Utilizing the jurisdictional boundaries for the contextual-level is generally useful, because they are geographic units with functional integrity according to which government enumerates and allocate resources, and frequently include useful information that characterizes the sociodemography of inhabitants (Boyle and Willms 1999). For instance, the *county* in the US is an example of a functional unit for which information is readily available on such things as population composition and social and economic organization, from government and private data collection sources (Clarke et al. 1994).

In Korea, the basic administrative boundaries are the *shi* for urban areas and the *kun* for rural areas. The *shi*s include several *ku*s and each *ku* is in turn divided into several *dong*s. In the case of rural areas, each *kun* includes several *eup*s. Although *shi*s and *kun*s are the largest administrative areas for the urban and the rural areas, respectively, they are not analogous in terms of the size of population and the capacity and integration of economic activity. Further, even among urban areas, some *shi*s (e.g., Seoul or Pusan) overwhelm other smaller *shi*s

in their size and complexity, and several small *shi*s even have *eup*s, rather than *ku*s, as their lower-level components. Thus, the complicated division of administrative areas in Korea makes it difficult to define the most substantively meaningful units (macro-level).

In this dissertation, two administrative areas are employed at the macro-level: the *dong*s for urban areas and *eup*s for essentially rural areas. Metropolitan Seoul includes Seoul as the center of the Metropolis and its neighboring areas. Over the past four decades of industrialization and postindustrialization, as discussed earlier, the actual boundary of Seoul has been expanded, and its neighboring areas have changed from a mainly rural character to take on urban features, in terms of population size, economic activities, and dependency on Seoul. Although most neighboring areas of Seoul are now of urban character, there still are areas which show mainly rural characteristics. Therefore, *dong*s for urban areas and *eup*s for rural areas appropriately represent the macro-level unit for Metropolitan Seoul.

In addition to the fact that the Korean government implements policies and allocates resources based on the minimal administrative units, *dong*s and *eup*s, they significantly affect the life of their residents in many practical ways. For example, *dong*s and *eup*s are the basis for postal address, and birth, death, and marriage registrations are handled by the administrative office of each *dong* or

eup. Furthermore, these two administrative units represent the primary sampling units (PSUs) of the 1998 Korean National Health and Nutrition Survey (KNHNS) which is the source of individual-level data employed in this project (A comprehensive examination on this data set will be introduced shortly). This means that *dong*s and *eup*s correspond to the PSUs of the 1998 KNHNS, which provides the practical rationale for utilizing these two units to represent the macro-level area units in Korea as well as in Metropolitan Seoul. In Metropolitan Seoul, there are 731 *dong*s and 168 *eup*s of which the population size ranges from 1,860 to 41,270 with average of 19,773 individuals. A total of 77 PSUs are included in the 1998 KNHNS.

2. VARIABLES AND MEASUREMET

A. Dependent Variables

This project aims to describe and explain the general health status of Metropolitan Seoul residents, with regard to the effects of micro- and macro- risk factors. Therefore, the dependent variable of this project is health outcome. Health, in general, is multidimensional, which implies that there is no sole indicator that measures one's overall health status. To measure the health of

Metropolitan Seoul residents, I look at four indicators of health that have been widely used in numerous health-related studies: activity limitation status, status of chronic diseases, self-rated health status, and number of hospitalization days.

a. Activity Limitation Status

I focus on whether the normal daily activities of adults in Metropolitan Seoul are limited by disability, regardless of the causes of disability, and I distinguish those with activity limitations from those with no limitations. In the survey of 1998 KNHNS, responses for activity limitations are coded in four categories regarding the level of severity of impairment. However, fewer than 2% of adult residents in Metropolitan Seoul have a severe disability. Therefore, I combined three levels of disability together into a category of activity limitations as opposed to no limitations. Activity limitation has been known to be highly correlated with presence of chronic disease, and both activity limitations and chronic diseases are significantly associated with higher risk of mortality (Rogers 1995; Rogers, Hummer, and Nam 2000). Further, individuals with activity limitations may experience a severe disconnect from both formal and informal social networks, which, in turn, may lead to poorer health, including mental or emotional problems. Young adults are unlikely to be functionally limited

(Verbrugge 1989). However, if they have a limitation, it could be a severe threat to subsequent survival (Rogers, Hummer, and Nam 2000).

b. Chronic Disease Status

In 1998, according to the National Statistical Office of Korea (1999), four of five leading causes of death are cerebrovascular diseases, heart diseases, malignant neoplasm of lung, and liver diseases including cirrhosis, and over 45 percent of total deaths was attributable to these chronic diseases. And among elderly Koreans, the relative prevalence increases to over 70 percent. This implies that most adult Koreans will die with at least one of these chronic conditions. Whether one suffers from chronic diseases tells us not only the physical health status, but also provides some insight into health-related attitudes and behaviors, of that person. For instance, cirrhosis has been known to be strongly associated with heavy drinking. Although genetic inheritance is also possible, heart disease is also known to be substantially related with unhealthy diet habits and excessive stress. Chronic disease includes more than those conditions that are life-threatening. A substantial number of adults suffer from several minor diseases that are not life-threatening, but which constantly affecting daily life. For instance, musculoskeletal diseases are very common to elderly populations. Although these minor chronic diseases are not life-threatening, they

can bring limitations in daily/regular activities to individuals, which can limit social connections, which in turn, can increase the risk of mental/psychological problems. To take into account the differences in the severity among chronic diseases, I divide chronic diseases status into three categories in this dissertation: Persons with life-threatening chronic diseases (severe), persons with minor chronic diseases (moderate), and persons without any chronic diseases. The first category (severe chronic disease) includes individuals who have at least one of the five-leading causes of death conditions (except deaths caused by auto accidents) for Koreans in 1998. The second category (moderate chronic diseases) includes individuals who have at least one non-life threatening disease (among those not included in the first category). The last category includes individuals who have neither severe chronic diseases nor moderate chronic diseases. This classification is based on self-identified disease status in the 1998 KNHNS. Diseases that have lasted no longer than three months (such as colds, fractures, etc.) are not classified as chronic diseases.

c. Self-rated Health Status

Self-rated health status has been utilized as a global measure of health by a number of previous studies (e.g., Ferraro and Farmer 1999; Mossey and Shapiro 1982; Idler and Benyamini 1997). This health measure has been known to be

strongly associated with mortality and morbidity (McGee et al. 1999). One who has a positive perception of his/her own health shows more favorable outcomes in both aspects of mortality and morbidity, compared to those who negatively assess their health. Some scholars have advised that caution has to be exercised when health status is compared across populations using self-rated health status, since it is a subjective measure. It is possible that one might assess one's own health as poor, even though actual health, based on objective measures such as doctor's diagnosis, is good (Obviously, the reverse is also possible). To illustrate, Angel and Guarnaccia (1989) find among Mexican immigrants in the US that they have tendency toward somatization or exaggerating health problems. However, the advantage in actual health associated with positive self-assessment of health remains unchanged even after controls for individuals' demographic and SES characteristics (Cho, Frisbie, Hummer, and Rogers *forthcoming*; McGee et al. 1999; Bergmann et al. 1998). Moreover, the association between self-rated health status and mortality and morbidity does not change even after consideration of physical health problems (Frisbie, Cho, and Hummer 2001). Consistent with previous studies (e.g., McGee et al. 1999; Frisbie et al. 2001; Kuo and Porter 1998), I dichotomize self-reported health in this dissertation: good health and poor health.

d. Annual Hospitalization Days

In general, annual hospitalization days or outpatient visits are used as proxy measures of access to health care. In particular, in societies where it is a responsibility of individuals to obtain health insurances (such as US), not everyone has equal access to health care. Further, whether one has proper access to health care or health insurance is dependent on the SES of that individual.

In Korea, a universal health insurance system has been in place since 1990, which means that all Koreans have access to basic health services. Although private supplementary health insurance for services not covered by national insurance have recently emerged, primary health care services are equally accessible to every Korean regardless of their SES. Therefore, if someone is hospitalized, this is more of an indication of health service utilization more than of access to health care.

In a similar study that utilized annual hospital visits as a proxy of access to health care (Frisbie et al. 2001), the authors used three categories for annual hospital visits (no visits, 1-2 visits, and 3 plus visits) to take into account the severity of illness. In this project, however, I dichotomize hospitalization status as (1) ever hospitalized and (2) never hospitalized, since the number of respondents who experienced hospitalization more than 2 days was not large enough to generate stable parameter estimates in multivariate analysis.

B. Independent Variables

a. Individual-level Risk Factors

Since there have been few studies in Korea of the sort that approaches general health status from the sociological point of view, utilizing multivariate analysis and nationally representative data, I have based the selection of individual risk factors on studies on health of individuals in other societies. The individual-level risk factors I analyze include [1] demographic variables, viz., age, sex, number of family members, and marital status and [2] SES indicators, viz., educational attainment, employment status, subjective social status, and family income. Occupation of respondents could be an important risk factor. However, in the preliminary research of this dissertation, no significant differentials in the effect on health were found among three occupational categories (professional, white collar, and blue collar). One unique variable for SES in this research is subjective social status. Given the general tendency of under/over reporting one's own family income, this variable would be a useful addition in measuring SES. In the 1998 KNHNS, respondents were asked to select one among five categories (Very high, high, middle, low, and very low) for their self-perception of the social status. The actual question was "How would assess your own socioeconomic status?" Studies from other societies (mainly from Western societies) have

reported rather consistent relationship between health outcomes and each of demographic/SES risk factors (e.g., Williams and Collins 1995; Rogers et al. 2000; Rogers 1995). Of interest in this dissertation, is whether or not this relationship generally found in Western societies is also witnessed in Korean society. Age, family size, and family income are analyzed as continuous variables, while other risk factors are considered as categorical variables.

b. Contextual-level Risk Factors

As I mentioned in the previous chapter, three aspects of context which likely affect the health of adult residents of Metropolitan Seoul are included in this dissertation: Area level SES, public/organizational aspects, and structural aspects. For area level SES, I look at three variables: percentage high income families, percentage of residents who are college graduates, and average residential land values. Average residential land value constitutes a fairly objective indication of area SES, but does not necessarily reflect the compositional characteristics of residents. The percentage of high income families (two million won or greater per month) provides an indication of the latter, especially given what we believe is a tendency for high income persons in Seoul to cluster geographically, regardless of tenure (i.e., whether residents are owners or renters of housing). The percentage of college graduates is expected to

reflect both the socioeconomic status of areas and norms and values that directly or indirectly affect the health behaviors of individuals. Given the importance of educational attainment as a major determinant of social class in Korean society, it is not hard to imagine that residential clustering in Metropolitan Seoul would be shaped according to not only high family income but also high educational attainments, which is reflected in first order bivariate correlation coefficients between two variables. The correlation coefficient of percentage of high family income and percentage of highly educated population is 0.86. Public/organization aspects, in terms of health, involve the effort of public/private organizations to promote the health of residents. For this, I look at the provision of public and private health care services. Provision of public health care is measured here by the amount of public expenditure for social development. Provision of private health care is measured by the number of physicians per 1,000 individuals. As a partial indication of structural aspects of areas, I focus on environmental quality and employ the total number of pollution emitting facilities per square kilometer as a proxy for environmental quality. While it is deemed important to include a measure of environmental hazard, unfortunately the data do not allow precise analysis. There is no information on either volume or toxicity of emissions. Nor is it possible to take into account factors which may affect exposure, such as

prevailing winds and spatial distance from pollution emitting facilities. All contextual-level risk factors are analyzed as continuous variables.

3. DATA

In order to accomplish the proposed contextual analysis, data for both individuals and areas were acquired and concatenated.

A. Level 1 - Individual Data

Individual-level health-related information was derived from the 1998 Korea National Health and Nutrition Survey (KNHNS). In Korea, data sets that involve individual-level health and health-related information at the national level are rare, which may well explain why most previous health-related research in Korea has been limited to local level analyses. The Ministry of Health and Welfare of Korea has conducted triennial Health Interview Surveys since 1962. Until 1995, the survey was based on samples too small to guarantee the reliability of the outputs. In 1998, however, a sample of 13,000 households was drawn from 200 national primary sampling units (PSUs) based on the 1995 Korea Population and Housing Census, yielding 23,224 adults (age 25 and up). The PSUs are the

*dong*s for urban areas and *eup*s for rural areas, as described previously. The 1998 KNHNS has been used by researchers for the purpose of informing health policies for Koreans (e.g., Korea Institute for Health and Social Affairs 2000). The sampling design of the 1998 KNHNS takes into account the significant modifications in the size of population in several sampling units, due to construction of new towns which, as mentioned previously, play an important role in residential clustering. Since the KNHNS is specially designed for health research, it is rich in health measures, along with indicators of respondents' demographic and socioeconomic characteristics. In general, the KNHNS is fairly comparable to the National Health Interview Survey (NHIS) in the US (Cho, Frisbie, and Nam 2000). The response rate was 90.7 percent (Ministry of Health and Welfare 1999). As this project is limited to Metropolitan Seoul, from the 1998 KNHNS, I extract 77 PSUs which included 9635 adult non-institutionalized respondents (age 25 and up) living in Metropolitan Seoul at the time of survey.

The 1998 KNHNS contains the core survey and three supplemental surveys: the health attitude and behavior supplement, the nutrition supplement, and the health examination supplement. For this project, I employ the core survey and the health attitude and behavior supplement. One out of three core survey cases was selected for the health attitude and behavior supplement, constituting of

8823 respondents from the entire country and 3170 adults from Metropolitan Seoul (Ministry of Health and Welfare, Korea 1999).

Earlier I described the four dimensions of health to be examined in this project: activity limitations, chronic disease status, self-rated health status, and annual hospitalization days. For the first three response variables, the core survey is used, while the health attitude and behavior supplement is used for the last response variable to analyze the health of Metropolitan Seoul residents and area variations.

B. Level 2 – Contextual Data

Since the KNHNS is a micro data set based only on individual information, it was necessary to construct a data set that includes macro-level information that can be linked to the individual-level data. As discussed above, the macro-level unit of analysis utilized in this project is *dong*s and *eup*s for urban areas and rural areas, respectively, which are the minimal administrative entities of Korea. In creating the macro-level data set for contextual risk factors, introduced in the section on variables in this chapter, three different sources were utilized. Aggregated statistics of the 1998 KNHNS by PSUs is the first source. That is, I aggregated individual reports on certain characteristics to the PSU level,

generating what has been referred to as compositional characteristics (Duncan et al. 1999; Bosma et al. 2001). As I addressed in Chapter 2, effects from the compositional characteristics are part of contextual effects that exist above and beyond the characteristics of individuals. The contextual variable that I obtain from aggregating individual reports to the PSU level is the percentage of high family income individuals (2 million KW and above per month) and the percentage of individuals who have a college degree. The second source of contextual data is the 1999 Official Land Value (Korean Association of Property Appraisers 2000). The official land value is determined by the Ministry of Construction and Transportation of Korea based on the current market value of the land, and thus provides an objective measure of area socioeconomic status not based on aggregating self-reported individual responses. Here, I employ the average land value for housing purposes only of each PSU (*dong* and *eup*).

The third source is the Annual Statistical Report from each *ku* and *kun* in Metropolitan Seoul. The *ku*s and *kun*s are the next highest level of the Korean governmental hierarchy – *ku*s for the urban area and *kun*s for the rural area (this was discussed in the section for unit of analysis in this chapter), and they are the minimal administrative self-governing bodies in Korea. In Metropolitan Seoul, there are 42 *ku*s and *kun*s, and each *ku* or *kun* includes over 10 *dong*s and *eup*s, respectively. Each year, they publish annual statistical reports that contain

information on various features of each *ku* and *kun*, and the format of reports are analogous across all *ku*s and *kun*s. I acquired contextual information on health services, potential environmental risks, and public expenditure for social development of areas (PSUs – *dong*s and *eup*s) from the 1999 annual statistical reports for corresponding *ku*s and *kun*s. Data utilized to measure these three contextual variables from the 1999 annual statistical report include (1) number of physicians per capita (calculated per 1,000 residents), (2) number of pollution emitting facilities per square kilometer, and (3) amount of public expenditure for social development per capita, respectively. In the 1998 KNHNS, usually one PSU is selected for a *ku* or *kun*, although there are cases where two or more PSUs are selected from a *ku* or *kun*. I allocate information on those three variables derived from *ku*s and *kun*s to corresponding *dong*s and *eup*s. In other words, each of the smaller units was assigned the value recorded for the larger unit of which they are a part. The rationale underlying this strategy is reasonably straightforward. Number of physicians, pollution facilities, and public expenditure for social development have impacts on lives of individuals across a wide geographic area. This is the reason that Korean government enumerates these pieces of information based on *ku*s and *kun*s, rather than on *dong*s and *eup*s.

C. Data Linkage – Final Data Sets

For the purpose of linking the micro data with the macro data, I first assigned ID numbers to each of the macro units (PSUs: *dong*s and *eup*s). I gave the same ID number to the individuals from corresponding PSUs in the 1998 KNHNS. Then I linked the micro data with the macro data based on ID numbers, creating a final data set of 9,635 adult individuals (level 1) who are nested in 77 PSUs (level 2) of Metropolitan Seoul. In the case of the final data set for the analysis of self-rated health status, a total of 3170 adult individuals nested in 77 PSUs are included in the final data set, since the micro data are derived from the health attitude and behavior supplement.

4. METHODS

The basic analytical tool that is used for this dissertation is regression modeling, including the random effects multilevel technique. This method is often called hierarchical linear modeling (HLM) or mixed effect modeling, because it is designed to correspond to hierarchically structured data and because the method makes it possible to differentiate random effects from fixed effects (Byrk and Raudenbush 1992). Recently, many studies in the fields of education, sociology and public health have utilized random effects multilevel analysis

techniques to analyze nested data, simultaneously examining the effect at the individual level and the group level (Raudenbush and Byrk 1986; Diez-Roux 2000; Guo and Zhao 2000). Since this technique makes it possible to differentiate the effects of individual risk factors from the macro-level risk factors, it is especially advantageous in place-sensitive health-related studies (Duncan, Jones, and Moon 1993).

It has been shown that the random effects multilevel technique can generate more efficient and less biased parameter estimates than conventional regression models, when data involve individuals nested in macro-units (e.g., areas) (Kreft and De Leeuw 1998). When a group of individuals reside in a community, sharing the same neighborhood contexts (neighborhood SES, local level public policy, pollution, health service facilities, health-related values, etc.), it is probable that their health status or health-related behaviors substantially differ from those of other groups of individuals who reside in a different community context, regardless of individual attributes. This implies heterogeneous error variances across macro-units, areas (Kreft and De Leeuw 1998). In this situation, to examine the health of individuals using conventional regression analysis may generate estimates that fail to capture the within-area correlation, biasing both coefficients and standard errors. Conventional regression analysis implies that the effects of independent variables on dependent

variable are constant (fixed) across all areas and all nested individuals, although it is clearly possible that the effects of independent variables vary across areas.

To examine the variation of effects of independent variables across groups, an alternative is to dummy code for all included areas in the conventional regression analysis, or to define separate regressions for each group. However, neither approach is practical when large numbers of macro-units are included in data sets. In the case of this project where individuals are nested in 77 PSUs of Metropolitan Seoul, the analysis would include 77 model equations or 76 dummy codes for PSUs in a model. More importantly, these approaches treat the areas as unrelated and ignore the fact that areas are drawn from a large population with attributes in common (Diez-Roux 2000). In contrast, random effects multilevel analysis takes into account the nested data structure and error terms both from individuals and areas in a single equation. The use of random effects multilevel analysis allows one to "decompose the variance in the dependent variable into the within-context variance and the between-context variance" (DiPrete and Forristal 1994). In particular, the between-context variance is very useful information for studies that emphasize area variations in health status, because the value of the between-context variance implies the significance and magnitude of variations across areas.

A general model of random effects multilevel analysis is as follows (Bryk and Raudenbush 1992; Snijders and Bosker 1999; Kreft and DeLeeuw 1998):

$$Y_{ij} = \beta_{0j} + \beta_{1j}X^{1}_{ij} + \beta_{2j}X^{2}_{ij} + e_{ij} \qquad e_{ij} \sim \mathrm{N}\,(0, \sigma^2) \ldots\ldots\ldots\ldots\ldots\ldots(1)$$

where Y_{ij} = outcome variable for *i*th individual in *j*th macro unit (area), X_{ij} = individual level independent variables for *i*th individual in *j*th macro unit, and e_{ij}= individual level errors within each macro unit. The individual level errors are normally distributed with a mean of 0 and a variance of σ^2. If the intercept and X_1 vary across areas, and they are dependent on an area level contextual variable Z, their regression coefficients as defined in equation 1 (β_{0j} and β_{1j}) are modeled as a function of the area level variable.

$$\beta_{0j} = \gamma_{00} + \gamma_{01}Z_j + U_{0j} \qquad U_{0j} \sim N\,(0, \tau_{00}) \ldots\ldots\ldots\ldots\ldots\ldots(2)$$

$$\beta_{1j} = \gamma_{10} + \gamma_{11}Z_j + U_{1j} \qquad U_{1j} \sim N\,(0, \tau_{11}) \ldots\ldots\ldots\ldots\ldots\ldots(3)$$

where Z_j is an area level contextual effect. U_{0j} and U_{1j} are macro errors normally distributed with a mean of 0 and a variance of τ_{00} and τ_{11}, respectively. These macro level error terms measure the unique deviation of the intercept and β_{1j} of each group from the overall intercept (γ_{00}) and the overall macro slope (γ_{10}). Once equations 2 and 3 are applied, the model fitted in multilevel analysis is:

$$Y_{ij} = \gamma_{00} + \gamma_{01}Z_j + U_{0j} + (\gamma_{10} + \gamma_{11}Z_j + U_{1j})\, X^1_{ij} + \beta_{2j}X^2_{ij} + e_{ij}$$

then, $$Y_{ij} = \gamma_{00} + \gamma_{10}X^1_{ij} + \beta_{2j}X^2_{ij} + \gamma_{01}Z_j + \gamma_{11}Z_j\, X^1_{ij} + U_{0j} + U_{1j}\, X^1_{ij} + e_{ij} \ldots\ldots (4)$$

This final model includes individual effects (γ_{10} for X^1_{ij}, and β_{2j} for X^2_{ij}), contextual effects (γ_{01} for Z_j), their interaction effects (γ_{11}), and the variance components that can be decomposed to macro level U_{0j} for a random intercept component and U_{1j} for a random slope component, plus individual level error variances (e_{ij}). Thus, this model contains both fixed effects and random effects. If there is no variability across areas, the error terms for the intercept and slope for the X^1_{ij} variable will be zero, and the equation will be analogous to the fixed effect only model, suggesting individuals within communities are independent (Diez-Roux 2000).

Multilevel analysis techniques can also be used for binary, count, and multiple-category outcomes. For instance, Guo and Zhao (2000) and Wong and Mason (1985) describe a multilevel model strategy for a dichotomous dependent variable.

$$\text{Log}\,[p_{ij} / (1\text{-}p_{ij})] = \beta_{0j} + \beta_{1j}X_{ij}$$

where $\beta_{0j} = \gamma_{00} + \gamma_{01}Z_j + U_{0j}$

and $\beta_{1j} = \gamma_{10} + \gamma_{11}Z_j + U_{1j}$

$$\text{therefore, } \text{Log}\,[p_{ij} / (1-p_{ij})] = \gamma_{00} + \gamma_{01}Z_j + U_{0j} + (\gamma_{10} + \gamma_{11}Z_j + U_{1j})X_{ij}$$

$$= \gamma_{00} + \gamma_{10}X_{ij} + \gamma_{01}Z_j + \gamma_{11}Z_j X_{ij} + U_{0j} + U_{1j}X_{ij}$$

$$= \gamma_{00} + (\gamma_{10} + U_{1j})X_{ij} + \gamma_{01}Z_j + \gamma_{11}Z_j X_{ij} + U_{0j} \ldots (5)$$

where, γ_{00} is the intercept, $(\gamma_{10} + U_{1j})$ is the parameter estimate for individual-level effect, γ_{01} is the parameter estimate for area-level effect, and U_{0j} is the random effect at the area level. Thus, random effect multilevel analysis can be applied to various types of outcome variables. Since dependent variables for this dissertation include binary outcomes (self-rated health status) and multinomial outcomes (activity limitations, chronic diseases, and annual bed days), multilevel models appropriate for such outcomes are used (Goldstein 1995; Muramatsu and Campbell 2002). The parameter estimates from the random effects multilevel analysis are produced using HLM software (version 5.3), which is a multilevel HLM microcomputer program developed by Bryk, Raudenbush, Seltzer, and Cognden (1988). This software is designed to generate estimates for coefficients and variance components from data structured in a nested fashion.

Although the random effects multilevel analysis technique is advantageous in various ways for a data set of nested structure, it is not always recommended and not always utilized for generating parameter estimates. Although data are collected from individuals nested in areas, if there is no significant macro-level

variance (no autocorrelation among individuals in the same area), it is not advantageous to utilize random effect multilevel technique over the conventional regression analysis techniques. Indeed, LeClere, Rogers, and Peters (1998) and Lee and Cubbin (2002) utilized conventional regression analysis for nested structured data. Whether or not the random effect multilevel analysis technique has to be used, in general, depends on the magnitude of intraclass correlation. The intraclass correlation refers to the proportion of variance caused by macro-units (Kreft and DeLeeuw 1998). Generally, the intraclass correlation coefficient (ρ) is calculated from the null model that does not include any explanatory variables. When the outcome variable is continuous, it is achieved by applying the following formula:

$$\rho = \tau_{00} / (\tau_{00} + \sigma^2) \ldots. (6)$$

where, τ_{00} is macro-level error variance and σ^2 is micro-level error variance, as described in equation (1) and (2). In the case of binary or multinomial outcomes, the intraclass correlation coefficient can be achieved by the following formula:

$$\rho = \tau_{00} / (\tau_{00} + \pi^2/3) \ldots. (7)$$

where, $\pi^2/3$ is the variance of the standard logistic distribution (Guo and Zhao 2000).

Random effects multilevel analysis technique imposes several theoretical and methodological constraints (Diez-Roux 1998, 2000). For instance,

multicollinearity may exist between macro-level variables and between macro-level and micro-level variables. Further, selecting of the contextual unit may influence the relationship between macro variables and individual level outcome variables. This issue deserves a more careful discussion because the social boundaries of a community or neighborhood may not always coincide with the geographical units, which may obscure the relationship. However, the problem of multicollinearity between independent variables arises even in the conventional regression analysis, and the situation in Metropolitan Seoul, as noted already, is that neighborhood characteristics appear to be adequately defined by the boundaries of administrative areas (*dong*s and *eup*s). Therefore, despite the possible restrictions, the random effects multilevel analysis technique appears to be the best choice for examining the role of contextual effects on the health of Metropolitan Seoul residents and the area variations across small areas, if substantial level of intraclass correlation for each outcome variable is detected. Two-tail test of significance is used for parameter estimate, except for the estimates of random intercept variance.

CHAPTER 4: MODELING STRATEGY AND RESEARCH HYPOTHESES

This chapter lists research hypotheses and describes models to analyze the health of adult residents and its variations across small areas in Metropolitan Seoul. Principally, my modeling strategy and hypotheses are designed (1) to investigate social factors associated with the elevated health risks among adult Metropolitan Seoul residents and (2) to examine the variations in health across small areas (PSUs) in Metropolitan Seoul.

1. RESEARCH DESIGN

In the following four chapters, I discuss four separate health outcomes to examine the health status of Metropolitan Seoul residents. Those four health outcomes are activity limitation, chronic diseases status, self-rated health status, and annual hospitalization days. The basic approach is not different across the four chapters. First, descriptive data in the form of percentage distributions of

each health outcome by individual level risk factors are presented, followed by a discussion of analytical results for each specific health outcome. The descriptive statistics will show the direction and the magnitude of the bivariate association between each individual risk factors and the health outcome. Second, I conduct a descriptive analysis of the bivariate association between each macro-level risk factor and each health outcome variable. This task is performed by looking at the Pearson correlation coefficients, which show the direction, magnitude, and significance of the association. Information from the bivariate association will be basis for later multivariate analyses. Significant correlations between a given macro-level risk factor and a health outcome implies that the contextual variable is in some way related to the response variable. The next step is to choose the most appropriate statistical method for the multivariate analysis. Since the data set employed in this project consists of individuals nested within PSUs, the random effect multilevel analysis technique is the choice to perform multivariate analysis. However, as I explained in the Methods section in the previous chapter, the random effects multilevel analysis technique is not always desirable. If individual effects do not vary significantly across PSUs, the random effects multilevel analysis is not advantageous compared to conventional regression techniques. To verify if there are significant and substantive variations in health outcomes across PSUs in metropolitan Seoul, I calculate the intraclass correlation

for each health outcome. There is no rule of thumb in regard to the magnitude of the intraclass correlation coefficient that would unambiguously indicate the utility of random effects multilevel analysis (Guo and Zhao 2000). Here, I base my decision on the statistical significance of macro variance of health outcome variables. That is, I conduct the random effects multilevel analysis for a null model (outcome variable only) to decompose error variance into micro- and macro-levels. Since the intraclass correlation coefficient is calculated by the combination of micro- and macro-variances, if the macro variance is not statistically different from zero, the intraclass correlation coefficient is heavily drawn from the micro-level error variance. In other words, my selection of the random effects multilevel analysis technique is based on the most generous approach to the question. Thus, if the macro-level error variance appears to be statistically zero, conventional regression analysis techniques (i.e., logistic regression analysis or multinomial logistic regression analysis) are utilized to generate parameter estimates.

The next steps include building analytic models. I first investigate the effects of individual risk factors on health outcomes through progressive adjustment. Analyses of individual-level risk factors for each health outcome involve five models. Model 1 is the null model that shows the overall risk for each health outcome before any controls. Model 2 includes age and sex, basic

demographic variables, which have been repeatedly shown to be strongly associated with adverse health outcomes. Given their crucial relationship to health outcomes, these two variables are included in all subsequent models. In Model 3, additional information on demographic characteristics of individuals (number of family members and marital status) is added to the model. To separate the effects of SES on adverse outcomes from other risk factors, I construct Model 4 only with SES related variables (educational attainment, employment status, family income, and subjective level of class). Model 5 is a full model for individual-level effects on health outcomes, which controls for all sociodemographic and SES risk factors.

Then I go on to include macro-level variables in the model. Again, one purpose of this project is to determine whether contextual risk factors have significant and independent effects on the health of Metropolitan Seoul residents. Controlling for all individual-level risk factors, adding contextual risk factors in the model one at a time will make it possible to detect the effect of each contextual characteristics on each health outcome. Given the assumption of non-multicollinearity between individual-level risk factors and macro-level risk factors, inclusion of contextual risk factors in the model may result in three possible conclusions. One, contextual risk factors have significant effects on the health of Metropolitan Seoul residents, independent of the attributes of individuals; i.e.

contextual risk factors may not modify the magnitude and significance of the effects of individual risk factors, while the coefficients of macro variables are statistically significant. Second, the contribution of contextual risk factors is nil regarding the risk of adverse health outcomes; i.e. the coefficients of those variables are not statistically different from zero and no changes are found in the coefficients of individual risk factors. Third, the contextual characteristics perform as either mediators or suppressors of individual risk factors; i.e. the magnitude and/or significance of the effects of certain individual risk factors are modified with the inclusion of macro-level variables in the model.

The last step is to investigate cross-level interaction effects between micro- and macro-level risk factors. As already discussed above, it may be that the effect of individual risk factors on the health outcomes may vary under different contextual characteristics. The decision about whether or not to include cross-level interaction terms, however, has to be preceded by a determination that the effects of any contextual risk factors are statistically significant. Further, theoretical and/or empirical antecedents should guide the inclusion of cross-level interaction terms in the model (Diez-Roux 2001). Multivariate modeling strategies, which involve individual- and PSU-level risk factors and possibly their cross-level interaction terms, will make it possible to address questions such as

whether and to what extent each individual and contextual characteristic influences the health of adult residents in Metropolitan Seoul.

Area variations in health status across PSUs in Metropolitan Seoul, which is another main subject of this project, have not been discussed. As mentioned earlier, if the random variance from the macro units comes out to be non-significant for a certain health outcome, it is not necessary to utilize the random effects multilevel analysis techniques for subsequent models. In this case, the main objective becomes narrowed to uncover the effects of individual- and area-level risk factors on health outcomes. In contrast, if significant random variance from macro-units is found, the magnitude and significance of the random variance become the subjects of considerable interest, because a significant random variance suggests that there are variations in the health outcome across small areas. Based on the modeling strategies described here, I report the random variance from the macro-units for each model, and analyze the changes in the variance across models. If random variance decreases or becomes non-significant as more micro- and/or macro-level variables are added into models, it indicates the variations in health across PSUs are mainly or partly caused by the risk factors. On the other hand, if random variance remains unchanged across models, it can be concluded that none of micro- and macro-level risk factors is responsible for the variations in health across small areas in Metropolitan Seoul.

2. RESEARCH HYPOTHESES

In Chapter 1, I introduced three purposes of this dissertation: (1) to document the extent to which area variations in health exist across small areas in Metropolitan Seoul, (2) to investigate which, and to what extent, social risk factors of both individuals and areas have an impact on the health of individuals, and (3) to suggest public health policy implications to promote the health of Metropolitan Seoul residents. To achieve these aims of this project, based on the research strategies, I address research hypotheses that will be tested by the following four chapters. These hypotheses and their test results will provide guidelines to assess the current health status of adult residents in Metropolitan Seoul, with regard to the effects of individual- and contextual-level characteristics, and to generate public policy implications to promote the health of these populations.

Hypothesis 1: Individuals' demographic and SES characteristics play a significant role in creating uneven distribution of general health status among adult residents of Metropolitan Seoul.

Hypothesis 2: Contextual characteristics of an area have significant effect on the health of its residents.

Hypothesis 3: Individual-level risk factors and area-level risk factors are independent on each other with respect to the influence on the health of Metropolitan Seoul adult residents.

Hypothesis 4: There are variations in the level of health across 77 primary sampling units of Metropolitan Seoul, which is attributable to individual- and/or area-level characteristics.

Hypothesis 5: Utilization of health services in Metropolitan Seoul is unevenly distributed among individuals and across areas, which is attributable to individual- and/or area-level characteristics.

CHAPTER 5: ACTIVITY LIMITATIONS

The first dimension of the contemporary health status of Metropolitan Seoul residents on which I focus is activity limitations. As described in the variable section in Chapter 3, activity limitation status has been the subject of much research. To measure one's health using activity limitations is not simple, because the cause and the level of limitations could be very different from person to person. For example, one's daily activity may be limited due to chronic disease related to aging (such as arthritis), while another person may have a disability caused by an accident. In this dissertation, I focus on whether the normal daily activities of adults in Metropolitan Seoul area limited by disability, regardless of the causes and the levels of disability. No more precise analysis is possible because information on the causes of disability is not available in the 1998 KNHNS, and the number of persons who have severe daily activity limitations is so small (less than 2%). Therefore, I combine those who report severe limitations and mild limitations into one category and compare with those with no limitations.

1. DESCRIPTIVE ANALYSES

Table 5.1 shows individual-level risk factor distributions by activity limitation status for Metropolitan Seoul residents. Age is predictably related to activity limitations in that the mean age of those who currently have some disability is about 62 years, while that of people with no limitations is about 42 years. Females are slightly more likely to be activity limited than males, which is consistent with previous studies on Western societies (Verbrugge 1989). Individuals with activity limitations are more likely to reside with fewer family members. In the case of marital status, about one-third of widowed persons are activity limited, followed by persons who are divorced or separated (15.3%). Only about 3% of singles are suffering from disability, which is even lower than the married percentage (6%). However, since marital status is strongly associated with age, the proportions of activity limitations for each category of marital status are probably largely a function of age.

Three individual risk factors for SES are included in the analysis for activity limitations: educational attainment, subjective social status, and family income. Employment status, which is included in the analyses for other dimensions of health status (hospitalization, chronic diseases, and self-rated health status), is omitted here, because the causal relationship between activity

Table 5.1. Descriptive Statistics for Individual-Level Risk Factors by Activity Limitations Status for Metropolitan Seoul Adult Residents

Independent Variables	Activity Limitation		N
	Yes	No	
Age (Mean)	61.8	42.3	9635
Sex (%)			
Male	6.6	93.4	4676
Female	9.6	90.4	4959
Number of Family Members (Mean)	3.3	3.7	9635
Marital Status (%)			
Married	6.0	94.0	7485
Single	3.4	96.6	1156
Widowed	33.5	66.5	791
Divorced/Separated	15.3	84.7	203
Educational Attainment (%)			
Some College or More	1.8	98.2	2431
High School Graduated	3.7	96.3	3750
Less than High School	17.4	82.6	3454
Subjective Social Status			
High	10.6	89.4	151
Middle	5.2	94.8	5114
Low	11.5	88.5	4370
Family Income			
High	4.1	95.9	3061
Medium	5.6	94.4	3859
Low	16.5	83.5	2280
Missing	15.2	84.8	435
N	785	8850	9635

Source: Korea National Health and Nutrition Survey (1998)

limitations and being either unemployed or not in the labor force is ambiguous. That is, activity limitations are at least as likely to be the cause as the consequence

of labor force participation status. Educational attainment shows a negative association with activity limitations. According to this descriptive bivariate relationship, over 17% of persons who completed less than a high school education are activity limited compared with less than 2% of those who went on to college. Family income also shows negative association with daily activity limitations. While only about 4% of high family income individuals have a disability, more than 16% of low income individuals suffer from activity limitations. Interestingly, the subjective ratings of one's social status show no clear pattern of association with activity limitations. However, only about 1.5% of respondents rated their own social status as high, while a majority of respondents classified themselves in the middle-class category. To assure the stability of parameter estimate, I combine those who rate themselves as high status with those who report being middle-class in the following regression analyses.

Column 1 and 2 of Table 5.2 provides descriptive statistics for PSU-level risk factors, and Column 3 shows the bivariate relationship for individual risk of activity limitation with area-level variation in SES, physician access, a proxy for public services, and a proxy for environmental pollution. Although the magnitude of association is not large, all three indicators of area-level SES (percent high

family income individuals, percent college graduates, and average official residential land value) have negative and significant associations with individual

Table 5.2. Descriptive Statistics for Area-Level Risk Factors and Correlation Coefficients for Each Risk Factor and Activity Limitations

Risk Factors	Mean	(SD)	Rho
Level 2 (Primary Sampling Units, PSU)			
High Family Income Individuals (%)[1]	31.77	(17.08)	-0.09**
College Graduated Population (%)[1]	25.23	(16.16)	-0.09**
Average Official Residential Land Value (1,000 Won)[2]	830.26	(521.43)	-0.04**
# of Physicians per 1,000[3]	1.28	(1.42)	0.02*
Public Expenditure for Social Developement per Capita (1,000 Won)[3]	191.00	(149.65)	0.06**
# of Pollution Generating Facilities per 1 Km^2 [3]	13.01	(18.08)	-0.01
Total Number of Level 2 Units	77		

**: p<0.01, *: p<0.05

Source: 1. Korea National Health and Nutrition Survey (1998)
2. Official Property and Land Value, Korea Association of Property Paaraisers (1999)
3. Annual Statistical Reports (1999)

risk. This suggests either the possibility that living in higher SES areas may lessen the risk of activity limitations for their residents in Metropolitan Seoul or that persons with activity limitations lack the resources to achieve and/or maintain residence in high SES areas. The coefficient pertaining to relative number of physicians present has a positive sign, which may also indicate reverse causation. That is, it may be that physicians are more attracted to areas in which daily activity limitations are more common; or perhaps there is some tendency for

activity limited Koreans to settle in areas where physicians are concentrated. The bivariate correlation coefficient for public expenditure for social development and activity limitations (0.06) indicates that persons with disability may be attracted to the areas where their daily activities can better be supported by public sectors, although it does not necessarily mean that expenditures for social development go directly for welfare facilities and services for the disabled. Presence of polluting facilities has a small, non-significant effect. This lack of a relationship may well be due to the measurement limitations described in the variable section at Chapter 3. That is, the effect of pollution depends on a number of factors (unmeasured here) such as the volume of emissions, proximity of living quarters to polluting facilities, and direction of prevailing winds. At this juncture, the clearest relationships seem to be that living in a more affluent area is associated with better individual health, and that availability or provision of medical and public service in the area attract individuals with daily activity limitations. The drawing of even tentative conclusions must, however, be deferred pending results from multivariate models.

2. MULTIVARIATE ANALYSES

A. Models with Individual-level Risk Factors Only

Table 5.3 displays the results of multivariate analysis of individual-level variables only. As I described earlier, the modeling strategy in this dissertation begins with capturing variations in health outcomes across PSUs in Metropolitan Seoul. To uncover whether or not there are significant variations in the level of activity limitations across areas, I first estimate random effect multilevel models with no covariates allowing the intercept to vary. The random intercept variance (0.301) in the baseline model indicates significant variation of activity limitations across the 77 PSUs. The intraclass correlation coefficient, calculated by the method explained in the methodology section, suggests that about nine percent of the total variation in predicting the individual activity limitations is accounted for by the variation at the PSU level. The significant value of the random intercept variance provides a rationale for utilizing random effects multilevel analyses for subsequent models with sets of covariates.

Consistent with previous financings, activity limitations, in Model 2, are more common among females than males and among residents of Metropolitan Seoul as they grow older. Model 3 adds number of family members and marital status. In this model, the advantage of males over females in activity limitations

Table 5.3. Effects of Individual Risk Factors on Activity Limitations Based on Random Intercept Models for Metropolitan Seoul (ages 25 and over)

	Model 1		Model 2		Model 3		Model 4		Model 5	
Fixed Effects	Coeffi.	SE	Coeffi.	SE	Coeffi.	SE	Coeffi.	SE	Coeffi.	SE
Individual Level										
Intercept	-2.450**	(0.074)	-7.172**	(0.198)	-7.134**	(0.247)	-7.935**	(0.263)	-8.256**	(0.316)
Age (cont)			0.093**	(0.003)	0.095**	(0.004)	0.084**	(0.003)	0.085**	(0.004)
Sex [Female]										
Male			-0.219*	(0.085)	-0.147	(0.092)	-0.087	(0.089)	-0.015	(0.096)
# of Family Member (cont)					-0.092**	(0.029)			0.003	(0.033)
Marital Status [Married]										
Single					1.082**	(0.196)			1.091**	(0.199)
Widowed					0.280*	(0.120)			0.335**	(0.120)
Divorced/Separated					0.998**	(0.231)			0.845**	(0.232)
Education [Some College +]										
High School							0.424*	(0.187)	0.487**	(0.187)
Less than High Sch							0.757**	(0.184)	0.810**	(0.186)
Subjective Social Status [High + Middle]										
Low							0.424**	(0.095)	0.403**	(0.097)
Family Income (High)										
Medium							0.288*	(0.130)	0.295*	(0.133)
Low							0.705**	(0.131)	0.688**	(0.147)
Missing							0.824**	(0.190)	0.761**	(0.200)
Random Variance										
Intercept	0.301**	(0.071)	0.252**	(0.067)	0.238**	(0.065)	0.183**	(0.055)	0.193**	(0.058)
Residual	1.000		1.000		1.000		1.000		1.000	
Deviance	5186.1		3992.4		3933.1		3885.6		3839.0	

Note: Coeffi.: Coefficient, SE: Standard Error
*: P<0.05; **: P<0.01
For activity limitations, 1=limited, 0=not limited

becomes non-significant. Unmarried persons (whether never married, separated/divorced, or widowed) are at significantly greater risk of activity limitations than married persons, but risk declines as family size increases. In

Model 4, which includes the SES indicators and deletes the family/marital status variables, the likelihood of activity limitations is significantly lower for persons with higher levels of education and family income. The case that higher SES promotes better health is more easily made for education. Education is typically completed early in life and can be expected to facilitate acquisition and implementation of knowledge of positive health behaviors. With respect to income, it may be that morbid or activity limiting conditions are more apt to be a cause of low income, rather than the reverse. The coefficient for subjective social status shows that individuals who classify themselves in the low social class are at a significantly higher risk of activity limitations than others who self-identify as middle/high class. The full model (Model 5) shows that age, marital status, and SES are strong risk factors for activity limitations for adult Metropolitan Seoul residents. Currently married persons enjoy substantially lower risk of activity limitations than their unmarried counterparts, net of other demographic and SES risk factors. In particular, singles have substantially higher odds of activity limitations, which is a consistent result in mortality studies. However, it could also be possible that one's disability status limits his/her boundary of social networks, and eventually inhibits the marriage opportunity. With all variables in the equation, family size is no longer associated with risk of activity limitations. Moreover, the magnitude of the coefficients for sex and family size are

substantially decreased in the full model. The advantages of higher SES, measured by educational attainment, subjective social status, and family income, for the risk of activity limitations remain unchanged in the full model.

Now, let us turn the focus to the area variations in the activity limitations. Including individual level covariates in Table 5.3 decreases the random intercept variance from 0.301 in the baseline model to 0.193 in the full model. Variances in all models remain significant, although confidence intervals (not shown) indicate that the differences in random intercept estimates are not significant at 95% confidence level. Inclusion of individual-level SES variables in Model 4 substantially lowers the value of random variance, and its 95% confidence interval slightly overlaps with that of the baseline model. This suggests that the variation in activity limitations across the 77 PSUs is partially attributable to the compositional characteristics of each PSU. That is, some PSUs have a lower level of activity limitations, compared to other PSUs, which is due to the fact that these PSUs have more individuals of higher SES which is associated with lower risk of activity limitations. Statistically significant random intercept variance in the full model, however, indicates that substantial variation in activity limitations across areas still remains unexplained even after controlling for individual level demographic and SES variables. The next step, hence, is to examine the

possibility that contextual characteristics provide explanations for the unexplained area-level variations.

B. Models Containing Both Individual- and Contextual-level Risk Factors

Table 5.4 shows the coefficients generated from random intercept models that also include five ecological variables in addition to individual characteristics. As indicated earlier, area-level education was excluded due to multicollinearity problems with area-level income. This table makes it possible to examine the effects of both macro- and micro-level variables on activity limitations of individuals and their contributions to variation in the level of activity limitations across 77 PSUs. The five PSU-level characteristics are average residential land values, the proportion of high family income individuals, the number of physicians per 1,000 residents, the amount of public expenditures for social development per capita, and the number of pollution generating facilities per square kilometer. Model 6 is the full model that contains all individual- and area-level variables in the same equation.

Net of individual-level characteristics, area attributes turn out to have neither significant nor substantial effects on the activity limitations of Metropolitan Seoul adult residents. Further, the coefficients of individual level variables remain largely unchanged even after controls for PSU-level risk factors.

Table 5.4 Effects of Individual and Macro Risk Factors on Activity Limitation Based on Random Intercept Models for Metropolitan Seoul (ages 25 and over).

	Model 1		Model 2		Model 3		Model 4		Model 5		Model 5	
Fixed Effects	Coeffi.	SE	Coeffi.	SE	Coeffi.	SE	Coeffi.	SE	Coeffi.	SE	Coeffi.	SE
Individual Level												
Intercept	-8.190**	(0.336)	-8.126**	(0.353)	-8.301**	(0.321)	-8.319**	(0.324)	-8.227**	(0.318)	-8.008**	(0.416)
Age (cont)	0.085**	(0.004)	0.086**	(0.004)	0.085**	(0.004)	0.085**	(0.004)	0.085**	(0.004)	0.086**	(0.004)
Sex [Female]												
Male	-0.016	(0.096)	-0.019	(0.096)	-0.015	(0.096)	-0.016	(0.096)	-0.015	(0.096)	-0.020	(0.096)
# of Family Member (cont)	0.003	(0.033)	0.005	(0.033)	0.004	(0.033)	0.004	(0.033)	0.004	(0.033)	0.006	(0.032)
Marital Status [Married]												
Single	1.092**	(0.199)	1.088**	(0.199)	1.089**	(0.199)	1.092**	(0.199)	1.092**	(0.199)	1.090**	(0.199)
Widowed	0.336**	(0.120)	0.335**	(0.120)	0.335**	(0.120)	0.337**	(0.120)	0.334**	(0.120)	0.336**	(0.120)
Divorced/Separated	0.851**	(0.232)	0.847**	(0.232)	0.842**	(0.232)	0.850**	(0.232)	0.848**	(0.232)	0.854**	(0.232)
Education [Some College +]												
High School	0.484**	(0.187)	0.474**	(0.188)	0.487**	(0.187)	0.485**	(0.187)	0.486**	(0.187)	0.471*	(0.188)
Less than High Sch	0.804**	(0.187)	0.788**	(0.188)	0.812**	(0.186)	0.804**	(0.186)	0.808**	(0.186)	0.780**	(0.188)
Subjective Social Status [High + Middle]												
Low	0.405**	(0.097)	0.397**	(0.097)	0.402**	(0.097)	0.407**	(0.097)	0.406**	(0.097)	0.399**	(0.097)
Family Income (High)												
Medium	0.293*	(0.133)	0.280*	(0.135)	0.295*	(0.133)	0.291*	(0.134)	0.295*	(0.133)	0.281*	(0.135)
Low	0.683**	(0.147)	0.669**	(0.149)	0.689**	(0.147)	0.680**	(0.147)	0.689**	(0.147)	0.672**	(0.148)
Missing	0.759**	(0.200)	0.747**	(0.200)	0.758**	(0.200)	0.755**	(0.200)	0.761**	(0.200)	0.741**	(0.201)
Macro Level												
Land Value	-0.000	(0.000)									-0.000	(0.000)
% High Family Income Individuals			-0.004	(0.004)							-0.003	(0.005)
# of Physicians per 1000					0.032	(0.044)					0.109	(0.070)
Public Expenditure for Social Development per capita							0.000	(0.000)			-0.000	(0.001)
# of Pollution Generating Facilities per Km^2									-0.003	(0.004)	-0.006	(0.004)
Random Variance												
Intercept	0.197**	(0.059)	0.198**	(0.059)	0.195**	(0.059)	0.197**	(0.059)	0.196**	(0.059)	0.201**	(0.062)
Residual	1.000		1.000		1.000		1.000		1.000		1.000	
Deviance	3837.9		3837.4		3838.5		3837.9		3838.1		3835.6	

Note: Coeffi.: Coefficient, SE: Standard Error

*: P<0.05; **: P<0.01

For activity limitations, 1=limited, 0=not limited

That is, even with all five macro-level variables included, one would come to exactly the same conclusions regarding the effects of every individual-level characteristic included in the analysis. (Compare the estimates for the micro-variables in Model 6 of Table 5.4 with Model 5 of Table 5.3.) Finally, the random intercept variances across models in Table 5.4 are not notably modified by the inclusion of macro-level attributes in the analysis. This suggests that the variations in the level of activity limitations across PSUs are not attributable to the contextual characteristics of each PSU included in this analysis, while a notable portion of areal variation was explained by the composition of high SES individuals, as discussed earlier. The significant value of random intercept variance in Model 6 (0.201) indicates that there still is notable clustering by activity limitations, which has not been fully accounted for by the risk factors included in this analysis.

3. SUMMARY

In this chapter, I examined the activity limitation status of adult residents of the Metropolitan Seoul area, paying attention to the effects of both individual- and area-level characteristics. In the case of demographic and SES characteristics

of individuals, the pattern of association witnessed in the descriptive analysis did not change much even in the regression analysis, except for the effects of sex and the size of family. In particular, three measures of one's SES (education, subjective social status, and family income) indicate that one's SES has a strong and protective effect on the risk of daily activity limitations for Metropolitan Seoul residents, net of other characteristics. In contrast, none of contextual characteristics included in the analysis affect the risk of activity limitations after controlling for individual-level risk factors, although the descriptive analysis shows significant bivariate association with activity limitations (except for pollution generating facilities). The non-significant effects of macro variables suggest no need of cross-level interactions in this case. There exists significant clustering of activity limitations across areas in Metropolitan Seoul, and it is partially explained by the composition of higher SES individuals in the area.

Significant random intercept variance in the full model with both individual- and PSU-level variables suggests further investigation with random slope models may be useful. Once random slopes are included in the model, random slope variance cannot be directly compared across models, due to the existence of covariance of random intercept and slope (Kreft and De Leeuw 1998). Indeed, I ran models allowing not only the intercept but also the effects of education and income on activity limitations to vary across areas (results are not

shown). As previous studies address (e.g., Diea-Roux 1998, 2002; Macyntire et al. 1993), it is possible that the effect of individual SES on health outcomes may vary across areas. In my models, however, the coefficients for random slope variances of education and income were not significant, indicating the effects of education and income on the risk of activity limitations are invariant across the 77 PSUs in Metropolitan Seoul.

CHAPTER 6: CHRONIC DISEASE STATUS

The second dimension of health that I will investigate is the chronic disease status of adult residents of Metropolitan Seoul. Chronic diseases are common, and they affect the lives of individuals in both physical and psychological ways, since chronic diseases, in many cases, prevent individuals from maintaining regular activities and bring psychological distress or isolation (Livneh and Antonak 1997). The leading causes of death in modern societies are chronic diseases. In particular, with the increases in medical costs, chronic illnesses have become the subject of much interest because such conditions normally require costly long-term care and treatment (Lubkin 1986). Although some chronic diseases are of genetic origin, most are developed during the course of one's life due to various factors of one's life style. For instance, lung cancer and bronchitis are strongly affected by heavy cigarette smoking, and liver related diseases are related to heavy alcohol intake. Thus, understanding the causes and patterns of chronic diseases is an important task in investigating general health status of a population. Nam et al. (1996) studied the general health status of Koreans utilizing chronic diseases as a main proxy measure. In this descriptive

study, these authors documented how socio-behavioral characteristics were associated with chronic diseases.

As already described in the variable section in Chapter 3, I classify responses on chronic disease status into three categories: individuals with no chronic diseases, individuals with moderate chronic diseases, and individuals with severe conditions. In terms of intensity of care or of mortality risk, certain chronic diseases are more severe or critical than others. For instance, one who suffers from heart disease has higher risk of mortality than someone else who has arthritis. To take this into account, based on the 1998 annual report on the cause of death statistics (National Statistical Office 1999), I differentiate severe chronic diseases that are also leading causes of death from chronic conditions that do not substantially threat one's life,. The severe chronic disease category contains liver diseases (including cirrhosis), malignant neoplasms of stomach, diabetes, heart disease, cerebrovascular disease, and malignant neoplasms of lung, bronchus, and other respiratory sites. Thus, individuals who self-identified as having at least one of these diseases are differentiated from others who have at least one other chronic disease. In this chapter, I analyze which, and to what extent, individual- and contextual-level characteristics influence the risk of chronic diseases, and investigate if there are variations in the level of chronic diseases across 77 PSUs in Metropolitan Seoul.

1. DESCRIPTIVE ANALYSES

Table 6.1 displays individual-level risk factors distributions by three chronic disease categories for Metropolitan Seoul adult residents. Age shows the expected strong monotonic relationship, with the severity of chronic diseases. Females have a slightly higher proportion of moderate chronic diseases than do males, but little difference is found between male and females in the case of severe chronic illness. Family size appears to be very slightly protective in regard to the susceptibility to chronic diseases. In the case of marital status, singles have a high proportion with no-chronic diseases and a low proportion with severe chronic diseases, compared to others, which mainly a function of age. Widowed individuals are at a greater risk of life threatening illnesses- age may underlie this finding. Percentage distributions for educational attainment also show a monotonic relationship with chronic disease status. That is, severe illness becomes more common as education increases. Individuals with less than a high school education are at a much higher risk of both types of chronic illnesses, compared to individuals with higher educational attainments. Here again, age might function as the cause of high risk of chronic diseases among low educated individuals, since the educational attainment of elderly populations is in general

Table 6.1. Descriptive Statistics for Individual-Level Risk Factors by Chronic Disease Status for Metropolitan Seoul Adult Residents

Independent Variables	Chronic Diseases Status			N
	None	Light	Severe	
Age (Mean)	38.9	44.3	55.9	9635
Sex (%)				
Male	39.1	47.8	13.1	4676
Female	33.4	53.0	13.7	4959
Number of Family Members (Mean)	3.8	3.7	3.6	9635
Marital Status (%)				
Married	35.2	52.0	12.8	7485
Single	57.9	39.5	2.7	1156
Widowed	14.4	51.8	33.8	791
Divorced/Separated	31.0	53.2	15.8	203
Educational Attainment (%)				
Some College or More	47.5	46.0	6.6	2431
High School Graduated	41.2	49.3	9.5	3750
Less than High School	22.5	54.9	22.4	3454
Employment Status (%)				
Employed	39.6	49.9	10.4	5757
Unemployed	35.3	53.8	10.9	2350
Not in Labor Force	24.2	47.5	28.3	1528
Subjective Social Status				
High	42.4	45.0	12.6	151
Middle	39.5	49.2	11.3	5114
Low	32.0	52.2	15.9	4370
Family Income				
High	40.2	49.6	10.2	3061
Medium	38.5	50.0	11.5	3859
Low	28.5	51.8	19.7	2280
Missing	26.7	54	19.3	435
N	3481	4863	1291	9635

Source: Korea National Health and Nutrition Survey (1998)

significantly lower than that of younger persons. Thus, it is necessary to proceed to the multivariate analysis in order to the relationship of interest. No substantial

differences are found between employed and unemployed individuals in the distribution of chronic illnesses. But, a higher proportion of severe chronic diseases is found among individuals not in the labor force at the time of the survey than among the currently employed or unemployed individuals. As with other health conditions, the direction of causation is partially (and perhaps mainly) reversed, as illness may well prevent labor force participation. Although only a moderate difference is found in the distribution of chronic diseases among three categories of subjective social status, there is a tendency for positive perception of one's own social status to play protective role in terms of the susceptibility of chronic diseases. Family income also shows a monotonic relationship with chronic diseases in that about 40% of high family income individuals are free from chronic diseases, as compared to 38.5% and about 29% of medium and low family income individuals, respectively. However, only small differences are found between high and medium family income individuals. Of interest is that majority of respondents (64%) self-reported that they have at least one either moderate or severe chronic diseases. Overall, the relationship between the distributions of chronic diseases among Metropolitan Seoul adult residents and each individual-level demographic and SES characteristic found in this chapter is consistent with findings from previous research (Nam et al. 1996).

Table 6.2 displays the descriptive statistics for area level risk factors and correlation coefficients for each risk factor and individual risk of moderate and severe chronic diseases. Descriptive distributions of each area-level risk factor across 77 PSUs are identical with those discussed in the previous chapter, since the same linked (individual + ecological) data set is used. In the case of moderate chronic diseases, the percentage of high family income individuals in the area is the only risk factor significantly associated with individual risk (rho = -0.02, $p<0.05$). However, most area-level characteristics employed in this analysis have significant bivariate associations with the individual risk of life-threatening chronic diseases. The affluence of area (measured by the percentages of high family income individuals and college graduated population) is negatively associated with the risk of severe chronic diseases. The coefficient pertaining to relative number of physicians present has a positive sign. It is probable that physicians are more attracted to areas where individuals of severe chronic diseases are more common, since severe chronic disease generally requires more intensive and longer-term medical treatment. It is also possible that individuals with severe chronic diseases also tend to reside in areas where they can more easily access physicians in light of physical distance. Indeed, Hadley (1982) found a similar (linear) relationship between mortality rates and the amount spent for Medicare. Recently, Porell and Miltiades (2001) found in a study of regional

Table 6.2. Descriptive Statistics for Area-Level Risk Factors and Correlation Coefficients for Each Risk Factors and Chronic Disease Status

Risk Factors	Mean	(SD)	Rho	
			Moderate	Severe
Level 2 (Primary Sampling Units, PSU)				
High Family Income Individuals (%)[1]	31.77	(17.08)	-0.02*	-0.05**
College Graduated Population (%)[1]	25.23	(16.16)	-0.02	-0.07**
Average Official Residential Land Value (1,000 Won)[2]	830.26	(521.43)	0.01	0.01
# of Physicians per 1000[3]	1.28	(1.42)	-0.00	0.03**
Public Expenditure for Social Developement per Capita (1,000 Won)[3]	191.00	(149.65)	0.01	0.04**
# of Populaton Generating Facilities per 1 Km^2 [3]	13.01	(18.08)	0.00	0.01
Total Number of Level 2 Units	77			

**: p<0.01, *: p<0.05

Source: 1. Korea National Health and Nutrition Survey (1998)
2. Official Property and Land Value, Korea Association of Property Paaraisers (1999)
3. Annual Statistical Reports (1999)

differences in functional limitations among elderly US population that functional limitations were more concentrated in places where more intensive medical care provided. The bivariate correlation coefficient for public expenditure for social development and severe chronic diseases (0.04, p<0.01) also suggests reverse causation. PSUs that spend more for social development (e.g., easily accessible public health centers) may attract people suffering from severe chronic diseases to settle in those areas.

2. MULTIVARIATE ANALYSES

A. Models with Individual-level Risk Factors Only

Table 6.3 displays the results of the multivariate analysis of individual-level variables only. Since there are significant error variances in predicting severe and moderate chronic diseases caused by level 2 units, I employ the random effect multilevel multinomial logistic regression analysis technique in this chapter. In Model 1 that includes the dependent variable only in the analysis, random intercept variances for severe and moderate chronic diseases are 0.209 and 0.145, respectively. Calculation of intraclass correlation coefficients for these random variances indicates that about 6% of the total variance for severe chronic diseases and about 4% of the total variance for moderate chronic diseases is accounted for by the variation across 77 PSUs. Model 2 adds basic individual demographic characteristics (age and sex). Consistent with the descriptive findings, age increases the risk of both severe and moderate chronic diseases. In the case of sex, no difference is found between males and females in regard to severe conditions. But moderate chronic diseases are significantly more common among females.

In Model 3, net of age and sex, coefficients for family size show that having more family members in household is protective with respect to both types of chronic diseases. Singles are substantially at lower risk of chronic

Table 6.3. Effects of Individual Risk Factors on Chronic Diseases Based on Random Intercept Models for Metropolitan Seoul (ages 25 and over)

	Model 1		Model 2		Model 3		Model 4		Model 5	
	Severe	Modera	Severe	Modera	Severe	Modera	Severe	Modera	Severe	Modera
Fixed Effects										
Individual Level										
Intercept	-0.987**	0.356**	-1.171**	0.571**	-1.132**	0.578**	-1.809**	0.275**	-1.722**	0.316**
Age (cont)			0.092**	0.038**	0.085**	0.032**	0.083**	0.031**	0.074**	0.024**
Sex [Female]										
Male			-0.061	-0.249**	-0.016	-0.208**	0.089	-0.148**	0.109	-0.118*
# of Family Member (cont)					-0.103**	-0.095**			-0.091**	-0.099**
Marital Status [Married]										
Single					-0.847**	-0.402**			-0.952**	-0.440**
Widowed					0.092	0.112			0.053	0.093
Divorced/Separated					0.146	-0.007			-0.005	-0.085
Education [Some College +]										
High School							0.261**	0.096	0.253*	0.104
Less than High Sch							0.515**	0.373**	0.519**	0.389**
Employment Status [Employed]										
Not in Labor Force							0.183	0.093	0.150	0.077
Unemployed							0.114	-0.047	0.256*	0.071
Subjective Social Status [High + Middle]										
Low							0.230**	0.143*	0.264**	0.175**
Family Income (High)										
Medium							0.100	-0.035	0.047	-0.089
Low							0.169	-0.003	0.087	-0.098
Missing							0.450*	0.244	0.367	0.145
Random Variance										
Intercept	0.209**	0.145**	0.170**	0.160**	0.162**	0.154**	0.147**	0.152**	0.142**	0.147**
Residual	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000

Note: Reference Category for Dependent Variable is No Chronic Diseases

*: P<0.05; **: P<0.01

diseases than married individuals, even adjusted for individual demographic characteristics, including age. This is an interesting finding since I speculated the advantage of singles in chronic diseases status observed in the descriptive analysis was a function of age. This may be the result of reverse causation. That is, those with chronic disease may be less likely to marry. Model 4 includes the SES indicators and deletes the family size/marital status variables. The lower the educational attainment, the higher the risk of chronic disease. The coefficients of subjective social status also show that a negative perception on one's own health is associated with higher risk of disease among Metropolitan Seoul residents. Employment status does not have significant effect on the risk of chronic diseases. Although not significant, the coefficients for family income show an interesting pattern. Individuals with a lower level of family income, as compared to their higher family income counterparts, have higher risk of severe chronic diseases but lower risk of moderate chronic diseases. This suggests that higher family income may be protective against life threatening illnesses. On the other hand, the advantage of high family income disappears in the case of moderate chronic diseases. In the full model (Model 5), adding all individual-level demographic and SES characteristics does not notably alter the significance and magnitude of risk factors on the risk of chronic diseases found in the previous models.

Including individual-level covariates in Table 6.3 slightly decreases the random intercept variance for severe chronic illnesses (0.209 in Model 1 to 0.142 in Model 5), but it has little effect on the intercept variance of moderate chronic diseases. This means that the variation in severe chronic diseases across the 77 PSUs is partly attributable to the compositional characteristics of each PSU, while area distribution of moderate chronic illnesses is not influenced by the composition of individual risk factors. Statistically significant random intercept variance in the full model, however, indicates that substantial variation in both severe and moderate chronic diseases across areas still remains unexplained even after controlling for individual level demographic and SES variables. The next step, hence, is to examine the possibility that contextual characteristics provide explanations for the unexplained area-level variations.

B. Models Containing Both Individual- and Contextual-level Risk Factors

Table 6.4 shows the coefficients generated from the random intercept models that include five ecological variables in addition to individual characteristics. Just as the case in the previous chapter on activity limitations, percentage of college or more education population is omitted here due to multicollenearity problem. When each area-level characteristics are added in the models (Model 1 through Model 5), no significant or substantial effect from the

Table 6.4. Effects of Individual and Macro Risk Factors on Chronic Diseases Status Based on Random Intercept Models for Metropolitan Seoul (ages 25 and over).

	Model 1		Model 2		Model 3		Model 4		Model 5		Model 6	
	Severe	Modera	Severe	Modera	Severe	Modera	Severe	Modera	Severe	Modera	Severe	Modera
Fixed Effects												
Individual Level												
Intercept	-1.733**	0.313**	-1.700**	0.325**	-1.725**	0.316**	-1.720**	0.318**	-1.721**	0.316**	-1.702**	0.323**
Age (cont)	0.074**	0.024**	0.074**	0.024**	0.074**	0.024**	0.074**	0.024**	0.074**	0.024**	0.074**	0.024**
Sex [Female]												
Male	0.109	-0.118*	0.108	-0.119*	0.111	-0.118*	0.109	-0.119*	0.110	-0.119*	0.109	-0.118*
# of Family Member (cont)	-0.089**	-0.099**	-0.090**	-0.099**	-0.089**	-0.099**	-0.091**	-0.100**	-0.091**	-0.100**	-0.056**	-0.098**
Marital Status [Married]												
Single	-0.955**	-0.441**	-0.956**	-0.441**	-0.957**	-0.440**	-0.953**	-0.440**	-0.954**	-0.440**	-0.965**	-0.443**
Widowed	0.052	0.094	0.052	0.092	0.055	0.093	0.054	0.094	0.054	0.093	0.054	0.094
Divorced/Separated	-0.018	-0.086	-0.004	-0.086	-0.016	-0.086	-0.003	-0.085	-0.008	-0.086	-0.016	-0.087
Education [Some College +]												
High School	0.263**	0.107	0.241*	0.099	0.257*	0.104	0.251*	0.103	0.253*	0.104	0.245*	0.102
Less than High Sch	0.537**	0.394**	0.499**	0.381**	0.523**	0.389**	0.513**	0.387**	0.519**	0.389**	0.504**	0.384**
Employment Status [Employed]												
Not in Labor Force	0.140	0.076	0.156	0.080	0.149	0.077	0.152	0.078	0.149	0.077	0.153	0.079
Unemployed	0.246*	0.070	0.262*	0.072	0.252*	0.071	0.260*	0.072	0.255*	0.071	0.259*	0.073
Subjective Social Status [High + Middle]												
Low	0.256**	0.173**	0.260**	0.173**	0.257**	0.175**	0.267**	0.176**	0.262**	0.174**	0.254**	0.174**
Family Income (High)												
Medium	0.054	-0.088	0.036	-0.094	0.050	-0.090	0.044	-0.091	0.047	-0.090	0.037	-0.094
Low	0.106	-0.095	0.072	-0.104	0.095	-0.098	0.082	-0.101	0.087	-0.098	0.082	-0.106
Missing	0.382	0.148	0.356	0.141	0.367	0.146	0.362	0.143	0.367	0.145	0.357	0.144
Disease [No]												
Yes												
Macro Level												
Land Value	0.000	0.000									0.000	0.000
% High Family Income Individuals			-0.003	-0.002							-0.004	-0.003
# of Physicians per 1000					0.073**	0.019					0.014	-0.053
Public Expenditure for Social Development per capita							0.000	0.000			0.001	0.001
# of Pollution Generating Facilities per Km^2									0.002	0.001	-0.001	0.000
Random Variance												
Intercept	0.133**	0.146**	0.143**	0.148**	0.131**	0.149**	0.144**	0.148**	0.144**	0.149**	0.130**	0.147**
Residual	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000

Note: Reference Category for Dependent Variable is No Chronic Diseases

*: P<0.05; **: P<0.01

contextual characteristics is found, except the effect of presenting physicians per 1,000 residents. In Model 3, net of individual-level demographic and SES characteristics, the coefficient of number of physicians for severe chronic diseases is significant and has a positive sign, suggesting that the relationship found from the bivariate correlation coefficient at Table 6.2 may be non-spurious to the characteristics of individuals. However, when all individual- and area-level risk factors are included in a model (Model 6), none of area characteristics shows a significant effect on either types of chronic disease. Moreover, random intercept variances for two categories of chronic disease remain almost unchanged across models in Table 6.4, compared to those of individual-level risk factors only model (Model 5 in Table 6.3). This means that area-level discrepancies in the prevalence of chronic disease are not attributable to the contextual profiles of the area. And the coefficients for individual-level risk factors are not changed much in either magnitude or significance by the addition of contextual profiles, suggesting the effects of individual-level characteristics on chronic diseases are independent of the contextual characteristics as measured in this research.

3. SUMMARY

In this chapter, I analyzed chronic health disease status of Metropolitan Seoul adult residents, paying special attention to social risk factors that might elevate the risk of chronic diseases. Descriptive analysis showed individual-level demographic and SES characteristics are associated with chronic diseases in a predictable manner. That is, younger age, being male, larger family size, and high SES are protective, although the magnitude of association varied for moderate and severe chronic diseases. The pattern of relationships between each individual-level predictor and chronic diseases remained almost unchanged even in the multivariate analyses. Of interest are the effects of single marital status and low level of educational attainment on chronic diseases. Advantages of being single in the descriptive analysis, compared to other marital status, was suspected to be a function of age. By the same token, the disadvantage of individuals with a low level of education was speculated to be a function of age, since elderly individuals generally have received lower levels of education compared to younger individuals. In the multivariate analysis, net of other individual risk factors as well as age, the advantage of being single over other marital status and the disadvantage of low educational attainment over higher level of education remained. In the case of low level of education, it is not surprising that the

finding is consistent with general pattern of association between educational attainments and health outcomes. However, the advantage of being single for this outcome variable, compared to other marital status, is puzzling, since in general, singles are at greater risk of bad health than their married counterparts, *ceteris paribus*, although it is probable that sick people are less likely to marry.

Several area-level characteristics showed significant bivariate associations with either moderate or severe chronic diseases in the descriptive analysis, indicating a possible influence of contextual risk factors on the individual risk of chronic diseases. However, once individual-level risks were simultaneously taken into account in multivariate models, none of those contextual risk factors turned to be influential on the odds of chronic diseases. In other words, area-level SES, provision of medical support, public expenditure, and the level of pollution have neither significant nor substantial impacts on the prevalence of chronic diseases in the area. Of particular interest is the area level of pollution. It is probable that environmental hazard would increase the probability of developing at least moderate chronic diseases among the residents. For instance, air pollution generated by heavy industries in the area would increase the risk of disease of the respiratory system among the residents. Perhaps, as indicated earlier in Chapter 3, the lack of effect is attributable to the fact that the proxy measure employed here for the level of environmental hazard (relative number of pollution generating

facilities) does not reflect either volume or toxicity of emissions. Nor does it take into account factors which may affect exposure, such as prevailing winds and spatial distance from pollution-emitting facilities. Further, length of residence and duration of exposure are not controlled in this study. Non-significant effect of contextual risk factor suggests no further need of cross-level interactions in the analysis.

Another interesting finding from this chapter is that both moderate and severe chronic diseases are unevenly distributed across 77 PSUs in Metropolitan Seoul area. Random intercept variances for moderate and severe chronic diseases obtained from random effects multilevel multinomial analysis techniques indicated that about 4% and 6%, respectively, of total variance were generated from the clustering of individuals in the level-2 units. Inclusion of individual- and area-level risk factors did not bring notable changes in the value of random intercept variance, although random intercept variance for severe chronic diseases slightly decreased with addition of risk factors. This variation in the level of chronic diseases across small areas in Metropolitan Seoul remains unexplained, which indicates the need of further investigation.

CHAPTER 7: SELF-RATED HEALTH STATUS

The third dimension of the contemporary health status of Metropolitan Seoul residents on which I focus is self-rated health status. As already discussed, self-rated health status has been shown to be strongly associated with mortality and morbidity (McGee et al. 1999). It has also been the subject of criticism in several studies that suggest that how one assesses one's own health is a subjective matter which is hard to compare with that of others (Idler and Benyamini 1997). McGee et al. (1999) found that self-assessment of health as bad or worse significantly elevated the risk of mortality among White and Black Americans.

According to previous studies, how one accesses his/her own health is significantly influenced by several characteristics of the individual, such as age, sex, marital status, and SES (Frisbie, Cho, and Hummer 2001; Cho, Frisbie, Hummer, and Rogers forthcoming). However, there has been little research that emphasized the role of contextual profiles on self-rated health status. In Korea, self-rated health status has been the subject of little research of any sort. Earlier, Nam et al. (1996) utilized self-rated health status to measure the general health of Koreans, finding bivariate relationships between this measure and demographic and SES characteristics of individuals. But their study was a descriptive analysis

limited to documenting relationships across risk factors. By contrast, the analysis reported in this chapter aims to document whether or not contextual characteristics have a significant impact on how an individual rates his/her own health, and to investigate which, and to what extent, individual demographic and SES characteristics affect self-rated health status among Metropolitan Seoul adult residents employing multivariate analytical techniques. Even though the 1998 KNHNS includes five ordinal scales as choices of respondents, here I dichotomize the responses by collapsing the responses as follows: (1) Good = responses of Excellent, Very Good, and Good, and (2) Poor = responses of Poor, and Very Poor. There are two reasons for this dichotomization. First, my preliminary analysis showed little to no difference in the pattern of association between the excellent, very good, and good responses and self-rated health status, while it was substantially different from the ways that poor and very poor responses were associated with the outcome variable. Second, many previous studies have used dichotomous self-rated health status in detecting the risk of mortality and morbidity, and largely found consistent outcomes. Note that the source of data for this chapter is the 1998 KNHNS - Health Behavior and Attitude Supplements that includes 3170 adult respondents from Metropolitan Seoul.

1. DESCRIPTIVE ANALYSES

Table 7.1 shows individual-level risk factors distributions by self-rated health status for Metropolitan Seoul residents. Older persons are more apt to negatively assess their own health. As was the case with activity limitations, males report more favorable health than females. Family size appears to have little or no effects on self-rated health. In the case of marital status, widowed or divorced/separated individuals are more likely to self-assess their health negatively than single or married individuals. Particularly, the proportion of negative self-rated health status among individuals who have lost their spouses is exceptionally high (42.6%). This finding is somewhat consistent with the pattern of association between widowed marital status and other health outcomes in the previous two chapters. In other words, widowed individuals are at high risk of inferior health status than those married, single, or even divorced/separated. However, the fact that widowed individuals are older means that age of respondents may be the primary determinant. Overall, a consistent pattern of relationship is found between each SES risk factor and self-rated health status. That is, the higher the SES, the better self-rated health. A positive monotonic relationship is found between educational attainment and positive self-rated health. Employed individuals have tendency to more positively assess their health than

Table 7.1. Descriptive Statistics for Individual-Level Risk Factors by Self-rated Health Status for Metropolitan Seoul Adult Residents

Independent Variables	Self-rated Health		N
	Good	Bad	
Age (Mean)	42.9	50.8	3170
Sex (%)			
Male	84.1	15.9	1514
Female	73.4	26.6	1656
Number of Family Members (Mean)	3.8	3.6	3170
Marital Status (%)			
Married	79.4	20.6	2483
Single	89.1	10.9	367
Widowed	57.4	42.6	256
Divorced/Separated	65.6	34.4	64
Educational Attainment (%)			
Some College or More	90.8	9.2	768
High School Graduated	84.3	15.7	1232
Less than High School	64.4	35.6	1170
Employment Status (%)			
Employed	85.2	14.8	1916
Unemployed	65.8	34.2	465
Not in Labor Force	73.0	27.0	753
Subjective Social Status			
High	82.2	17.8	45
Middle	83.7	16.3	1757
Low	71.7	28.3	1368
Family Income			
High	84.6	15.4	1060
Medium	81.0	19.0	1238
Low	67.5	32.5	738
Missing	67.2	32.8	134
Disease Status			
No Diseases	94.4	5.6	826
Have Chronic/Acute Diseases	72.9	27.1	2344
N	2488	682	3170

Source: Korea National Health and Nutrition Survey (1998)
- Health Behavior and Attitude Supplement

those who are unemployed or not in labor force. Turning to self-rated social status as a predictor of self-rated health, I find that the middle- and upper-social classes are also more likely to assess their own health to be good (over 80%) than those who view themselves as of low social classes (about 72%). In the case of family income, no substantial difference in self-rated health status is found between high family income individuals and medium family income individuals. However, low family income individuals show a substantial difference from those two groups of individuals in that about one-third of low income persons assessed their own health as poor, while less than 20% of medium to high family income individuals self-rated their health as poor.

Importantly, I include a variable indicating whether or not an individual has a disease condition. It is probable that one's self-assessment of health status is affected by his/her actual physical conditions (Frisbie et al. 2001). Therefore, I employ the question of whether or not respondents have chronic/acute diseases at the time of survey as an indicator of the actual presence of conditions. Obviously, individuals who have chronic or acute diseases tend to negatively assess their own health, compared to those without diseases. Thus, including an indicator of the actual presence of disease allows a more accurate specification of the effects of social risk factors (demographic and SES) and an assessment of the validity of the self-rated health measure.

Table 7.2 displays the descriptive statistics for macro-level characteristics and their correlation coefficients with the risk of assessing one's own health as poor. The correlation coefficients for percentages of high family income individuals and for college graduated population are significant and have a negative sign, suggesting that living in a more affluent area may be advantageous for Metropolitan Seoul residents, in terms of the self-rated health status. Although the coefficient for average official residential land value, as another measure of area-level SES, also has the expected negative sign, it is not significant. The correlation coefficients for other area-level characteristics are neither significant nor substantial in their magnitudes, implying they have no impact on the individual risk of assessing one's health as poor. At this juncture, living in a more affluent area indicates a relative advantage for the outcome variable among Metropolitan Seoul adult residents. However, just as in previous chapters, all but the most tentative conclusions should be postponed until multivariate regression analyses are carried out.

Table 7.2. Descriptive Statistics for Area-Level Risk Factors and Correlation Coefficients for Each Risk Factors and Poor Self-rated Health Status

Risk Factors	Mean	(SD)	Rho
Level 2 (Primary Sampling Units, PSU)			
High Family Income Individuals (%)[1]	31.31	(16.69)	-0.11**
College Graduated Population (%)[1]	24.77	(15.87)	-0.11**
Average Official Residential Land Value (1,000 Won)[2]	829.69	(520.85)	-0.03
# of Physicians per 1000[3]	1.26	(1.39)	-0.01
Public Expenditure for Social Developement per Capita (1,000 Won)[3]	190.08	(147.55)	0.03
# of Populaton Generating Facilities per 1 Km^{2} [3]	13.19	(18.54)	-0.02
Total Number of Level 2 Units	77		

**: p<0.01, *: p<0.05

Source: 1. Korea National Health and Nutrition Survey (1998)
2. Official Property and Land Value, Korea Association of Property Paaraisers (1999)
3. Annual Statistical Reports (1999)

2. MULTIVARIATE ANALYSES

A. Models with Individual-level Risk Factors Only

Selection of the most appropriate analysis tool is based on whether or not there are significant variations in self-reported health status across 77 PSUs in Metropolitan Seoul, as discussed in Chapter 4. Accordingly, I ran a random effects multilevel model only for the dependent variable (the probability of rating one's health as poor) without any covariates, which generated a coefficient for random intercept variance of a 0.09 (p=0.04). Although the random intercept

variance is significant, suggesting area variations in the pattern of self-rated health status, the magnitude of it is miniscule. That is, only 2.6% of the total variance in predicting the probability of poor health status among Koreans is caused by area clustering, while 97.4% is attributable to variations in individual characteristics. Moreover, my preliminary research (not shown in tabulation) demonstrated that once basic individual-level profiles (age and sex) are included, the significance of random intercept variance disappears. Therefore, I utilize conventional logistic regression techniques to generate parameter estimates for each individual- and area-level risk factors, since little or no advantage can be achieved from utilization of random effects multilevel techniques.

Table 7.3 displays the results of the individual-level variables only analysis. The baseline model (Model 1) includes the effect of age and sex. Consistent with the descriptive analysis and virtually all previous research, the likelihood of negatively assessing one's own health increases with age, and females are more likely than males to report poor health. Family size and marital status are added in Model 2. No effect of family size is found. Among categories of marital status, divorced/separated individuals are at stronger risk of negative self-rated health status, compared to married individuals, net of age, sex, and family size. Of interest are widowed individuals. In Table 7.1, the bivariate coefficients showed that widowed individuals were at a higher risk of poor health,

compared to other categories of marital status. However, their disadvantage disappears once respondents' sex and age are taken into account.

Table 7.3. Effects of Individual Risk Factors on Poor Self-rated Health Status Based on Logistic Regression Models for Metropolitan Seoul (ages 25 and over)

	Model 1		Model 2		Model 3		Model 4		Model 5	
Fixed Effects	Coeffi.	SE	Coeffi.	SE	Coeffi.	SE	Coeffi.	SE	Coeffi.	SE
Individual Level										
Intercept	-3.083**	(0.163)	-3.119**	(0.236)	-3.538**	(0.230)	-3.761**	(0.308)	-4.845**	(0.346)
Age (cont)	0.045**	(0.003)	0.046**	(0.004)	0.029**	(0.004)	0.030**	(0.005)	0.025**	(0.005)
Sex [Female]										
Male	-0.638	(0.093)	-0.645**	(0.097)	-0.308**	(0.111)	-0.313**	(0.118)	-0.284*	(0.120)
# of Family Member (cont)			-0.009	(0.033)			0.044	(0.037)	0.059	(0.038)
Marital Status [Married]										
Single			0.033	(0.190)			-0.015	(0.290)	0.153	(0.208)
Widowed			-0.111	(0.165)			-0.047	(0.175)	-0.038	(0.177)
Divorced/Separated			0.640*	(0.281)			0.519	(0.290)	0.425	(0.294)
Education [Some College +]										
High School					0.367*	(0.152)	0.343*	(0.153)	0.334*	(0.156)
Less than High Sch					0.865**	(0.166)	0.838**	(0.167)	0.804**	(0.170)
Employment Status [Employed]										
Not in Labor Force					0.499**	(0.125)	0.500**	(0.128)	0.485**	(0.131)
Unemployed					0.272*	(0.137)	0.263	(0.145)	0.240	(0.148)
Subjective Social Status [High + Middle]										
Low					0.437**	(0.100)	0.430**	(0.101)	0.397**	(0.102)
Family Income (High)										
Medium					0.091	(0.120)	0.118	(0.123)	0.125	(0.125)
Low					0.269*	(0.134)	0.325*	(0.147)	0.366*	(0.150)
Missing					0.407	(0.226)	0.456*	(0.231)	0.416	(0.235)
Disease [No]										
Yes									1.519**	(0.164)
Deviance (-2LL)	3039.4		3033.6		2933.0		2928.4		2813.1	

Note: Coeffi.: Coefficient, SE: Standard Error

*: P<0.05; **: P<0.01

For self-rated health status, 1=poor and 0=good

Model 3 adds individual-level SES risk factors on the baseline model. What was found in the descriptive analysis, regarding the relationship between SES risk factors and self-rated health status, remains consistent in this model. Individuals with a higher education, who are employed, have higher subjective social status, and high family income are at significantly lower risk of reporting their own health as poor, compared to their low educated, not currently employed, with low subjective social status, and low family income counterparts, respectively. Inclusion of SES risk factors in the model notably decreased the effects of age and sex on self-rated health.

Model 4 includes both individual-level demographic and SES risk factors. The magnitudes and significance found in the previous models do not change much in this model, except the relative effect of divorce/separation. As explained earlier, I include disease status of respondents in addition to demographic and SES characteristics in Model 5. Individuals who currently suffer from either chronic or acute diseases are much more likely to report their health as poor, as predicted, while this supports the validity of the self-reported health measure. This inclusion does not generate notable changes in the pattern of association between each risk factor and the dependent variable found in Model 4, which means age, sex, and SES risk factors have independent effects on the self-reported health status among Metropolitan Seoul adult residents. This result is also

consistent with the argument that self-reported health warrants consideration as an outcome.

B. Models Containing Both Individual- and Contextual-level Risk Factors

Table 7.4 displays the coefficients for the effects of both individual- and macro-level risk factors on the risk of negative self-rated health status. Again, to avoid problems of multicollinearity, the percentage of college graduated populations is omitted from the models. Bivariate correlation coefficients in Table 7.2 already indicated no association between self-rated health status and most macro-level variables. Consistent with the results of descriptive statistics, none of macro-level risk factors has a significant effect on the outcome variable, net of individual-level risk factors. Of interest is the percentage of high family income individuals. The correlation coefficient was significant and had negative sign in the bivariate association of the individual risk of poor self-rated health status. Net of individual-level characteristics in Model 2, the effect of area influence on the negative self-report of health becomes not significantly different from zero, suggesting that the relative advantage of residence in an affluent area observed in the bivariate association is due to higher composition of affluent individuals in the area. Inclusion of area-level characteristics in the analysis does not notably alter the significance and magnitude of the effects of individual-level

Table 7.4. Effects of Individual and Macro Risk Factors on Self-rated Health Status Based on Logistic Regression Models for Metropolitan Seoul (ages 25 and over).

	Model 1		Model 2		Model 3		Model 4		Model 5		Model 6	
Fixed Effects	Coeffi.	SE	Coeffi.	SE	Coeffi.	SE	Coeffi.	SE	Coeffi.	SE	Coeffi.	SE
Individual Level												
Intercept	-4.779**	(0.360)	-4.659**	(0.372)	-4.778**	(0.351)	-4.828**	(0.350)	-4.808**	(0.347)	-4.503**	(0.408)
Age (cont)	0.025**	(0.005)	0.025**	(0.005)	0.025**	(0.005)	0.025**	(0.005)	0.025**	(0.005)	0.026**	(0.005)
Sex [Female]												
Male	-0.285*	(0.120)	-0.288*	(0.120)	-0.285*	(0.120)	-0.283*	(0.120)	-0.291*	(0.120)	-0.295*	(0.120)
# of Family Member (cont)	0.058	(0.038)	0.059	(0.038)	0.056	(0.038)	0.059	(0.038)	0.066	(0.038)	0.066	(0.038)
Marital Status [Married]												
Single	0.154	(0.208)	0.146	(0.208)	0.152	(0.208)	0.152	(0.208)	0.161	(0.208)	0.152	(0.208)
Widowed	-0.035	(0.177)	-0.047	(0.177)	-0.034	(0.177)	-0.038	(0.177)	-0.037	(0.178)	-0.048	(0.178)
Divorced/Separated	0.435	(0.295)	0.423	(0.294)	0.439	(0.295)	0.424	(0.294)	0.467	(0.296)	0.463	(0.297)
Education [Some College +]												
High School	0.327*	(0.156)	0.300	(0.158)	0.328*	(0.156)	0.335*	(0.156)	0.327*	(0.156)	0.285	(0.158)
Less than High Sch	0.793**	(0.171)	0.747**	(0.175)	0.801**	(0.170)	0.809**	(0.171)	0.796**	(0.170)	0.736**	(0.176)
Employment Status [Employed]												
Not in Labor Force	0.490**	(0.131)	0.500**	(0.131)	0.485**	(0.131)	0.483**	(0.131)	0.482**	(0.131)	0.495**	(0.131)
Unemployed	0.245	(0.148)	0.252	(0.148)	0.244	(0.148)	0.237	(0.148)	0.242	(0.148)	0.248	(0.149)
Subjective Social Status [High + Middle]												
Low	0.401**	(0.103)	0.384**	(0.103)	0.401**	(0.102)	0.394**	(0.103)	0.405**	(0.103)	0.382**	(0.103)
Family Income (High)												
Medium	0.119	(0.125)	0.091	(0.128)	0.115	(0.125)	0.126	(0.125)	0.116	(0.125)	0.073	(0.128)
Low	0.355*	(0.151)	0.315*	(0.155)	0.355*	(0.151)	0.371*	(0.151)	0.368*	(0.150)	0.319*	(0.156)
Missing	0.411	(0.235)	0.382	(0.237)	0.414	(0.235)	0.418	(0.235)	0.421	(0.235)	0.385	(0.237)
Disease [No]												
Yes	1.520**	(0.164)	1.516**	(0.164)	1.521**	(0.164)	1.520**	(0.164)	1.520**	(0.164)	1.519**	(0.164)
Macro Level												
Land Value	-0.000	(0.000)									-0.000	(0.000)
% High Family Income Individuals			-0.004	(0.003)							-0.006	(0.004)
# of Physicians per 1000					-0.039	(0.034)					0.005	(0.052)
Public Expenditure for Social Development per capita							-0.000	(0.000)			-0.000	(0.000)
# of Pollution Generating Facilities per Km^2									-0.005	(0.003)	-0.005	(0.003)
Deviance (-2LL)	2812.7		2811.3		2811.8		2813.0		2809.8		2806.8	

Note: Coeffi.: Coefficient, SE: Standard Error

*: P<0.05; **: P<0.01

For self-rated health status, 1=poor and 0=good

profiles across models. In other words, contextual characteristics do not have any substantial influence on self-assessed health.

3. SUMMARY

In this chapter, I investigated the contemporary level of health for Metropolitan Seoul adult residents employing self-rated health status as a proxy measure of global health. As already noted above, this chapter goes beyond previous research on Korean health in the following two ways: (1) it utilizes multivariate analysis and (2) it takes into account both individual- and contextual-level characteristics as potential risks. Individuals who are socio-economically disadvantaged are at greater risk of poor health than their high SES counterparts, which is consistent with findings from Western societies. In particular, the magnitude of coefficients for individuals with less than a high school education are more than twice as high as the coefficients for those with a college degree, net of other risk factors.

The health disadvantage of low SES individuals, compared to higher SES persons, remained largely unchanged even after the control for individuals' chronic or acute diseases status. This result warrants special emphasis. Low SES individuals are already at greater risk of activity limitations and chronic diseases

than are their higher SES individuals, as discussed in previous chapters. By controlling for disease status, although disease status is not a perfect control for all health problems, it is possible to more adequately specify the effect of SES on health. The relationship between the perception of one's health status and the actual physical health is reciprocal. On the one hand, poor physical health causes negative perception of one's own health. On the other hand, a negative perception may lead to risky health habits and attitudes, which, in turn, could result in poor health. At this juncture, it appears that adult residents of Metropolitan Seoul who are socioeconomically disadvantaged are in a situation of double jeopardy: one from the higher risk of diseases per se, and also from unhealthy behaviors and attitudes which would increase the risk of disease and/or aggravate their *already* poor health.

None of the coefficients for area-level variables was different from zero in the multivariate models, although the bivariate correlation coefficient for the percentage of high family income individuals and individual risk of poor self-rated health status was significant. In other words, contextual variables, such as community SES, availability of medical services, pollution facilities, and expenditure for public health promotions, do not affect how one perceives his/her health status, once individuals' demographic, SES, and physical health status are taken into account. The non-significant effect of context also implies that cross-

level interactions are not necessary for better fitting models. Moreover, there were no significant variations in the probability of self-assessing health as poor across 77 PSUs in Metropolitan Seoul.

CHAPTER 8: HOSPITALIZATION STATUS-UTILIZATION OF HEALTH SERVICES

In the previous chapters, I investigated the health status of Metropolitan Seoul adult residents analyzing activity limitations, chronic diseases status, and self-rated health status. In this chapter, I turn my focus to the utilization of health services employing hospitalization status as a proxy measure. As discussed earlier in the chapter on data and methodology, hospitalization status reflects two dimensions: conditions of one's health and access to and/or utilization of health care and services. In general, one is not admitted to a hospital for minor illnesses. Being hospitalized, therefore, means that an individual experienced health problems that require more than medication and/or outpatient visits. Hospitalization is also related with whether or not one has resources or intentions to seek for proper medical cares. If someone does not have access to health services due to various reasons (such as lack of financial resources or transportation), it would not be easy to obtain hospital care regardless of severity of conditions. In this dissertation, I emphasize one's risk of hospitalization as a measure of access/utilization of health services, rather than as the proxy for severe conditions, because several dimensions of health measures have been already

discussed in the previous chapters. To clarify hospitalization status as the proxy measure of access/utilization of health services, I again control for individual-level disease status (chronic or acute diseases) in all regression models.

Korea has had a national health insurance service system in place since 1990. This implies that, basically, every Korean has equal access to health services, regardless of SES. Therefore, it warrants mention that hospitalization status measures one's intention or tendency to utilize health services for his/her severe health problems, rather than access. In a recent study, which employed the same data resource (1998 KNHNS), individual level demographic and SES profiles were investigated with regard to the risk of outpatient visits among Koreans (Cho, Frisbie, and Nam 2000). This current project is different from the work of Cho et al. (2000), since those authors focused on the utilization of health services for minor conditions, while utilization of health services for severe conditions is the focus here. Moreover, this project investigates the effect of area characteristics on the probability of health service utilization.

Duration of hospitalization may suggest the magnitude or the severity of medical conditions. That is, staying in bed over a week likely indicates more severe conditions, while one or a few days in bed may result from relatively less critical illnesses (e.g., Frisbie, Cho, and Hummer 2001; Cho, Frisbie, Hummer, and Rogers *Forthcoming*). Here, I dichotomize hospitalization status: (1) ever

hospitalized in the past year, and (2) never hospitalized, because the 1998 KNHNS includes very few respondents who experienced hospitalization for more than two days. That is, there are too few respondents with long hospital stays to generate stable parameter estimates in the multivariate regression analysis.

1. DESCRIPTIVE ANALYSES

Table 8.1 shows how individual-risk factors are distributed by hospitalization status for Metropolitan Seoul adult residents. Note that this descriptive analysis is before controls for one's disease status. Thus, in Table 8.1, hospitalization may indicate either or both utilization of health services and the risk of severe health problems. Unlike the case of health-related variables in previous chapters, age is not an evident risk of hospitalization among Koreans. Females are substantially more likely to experience hospitalization than are males, which is consistent with previous findings that women tend more to seek for medical services more than males (Hayward et al. 1991; Banks and Pandiani 1998). Family size is not associated with the hospitalization status distribution. In the case of marital status, being married is not advantageous over other categories of marital status with

Table 8.1. Descriptive Statistics for Individual-Level Risk Factors by Hospitalization Status for Metropolitan Seoul Adult Residents

Independent Variables	Hospitalization Status		N
	Yes	No	
Age (Mean)	43.5	43.9	9635
Sex (%)			
Male	4.8	95.2	4676
Female	8.9	91.1	4959
Number of Family Members (Mean)	3.7	3.7	9635
Marital Status (%)			
Married	7.2	92.9	7485
Single	3.8	96.2	1156
Widowed	9.1	90.9	791
Divorced/Separated	7.4	92.6	203
Educational Attainment (%)			
Some College or More	6.3	93.7	2431
High School Graduated	7.5	92.5	3750
Less than High School	6.8	93.3	3454
Employment Status (%)			
Employed	4.6	95.4	5757
Unemployed	9.0	91.0	2350
Not in Labor Force	11.3	88.7	1528
Subjective Social Status			
High	7.3	92.7	151
Middle	7.1	92.9	5114
Low	6.7	93.3	4370
Family Income			
High	6.0	94.0	3061
Medium	7.0	93.0	3859
Low	8.0	92.0	2280
Missing	7.1	92.9	435
Disease Status			
No Diseases	3.9	96.1	2897
Have Chronic/Acute Diseases	8.2	91.8	6738
N	785	8850	9635

Source: Korea National Health and Nutrition Survey (1998)

regard to hospitalization. Rather, singles have the lowest proportion of hospitalization (3.8%), which is consistent with previous findings that singles are less likely to utilize the health services than married individuals (e.g., Echevarria and Frisbie 2001; Rhoades and Chu 2000). Among the four SES-related risk factors, employment status is the only factor that shows a strong pattern of association with hospitalization status. While 4.6% of employed persons experienced hospitalization in the past year, 9.0% and 11.3% of unemployed persons and respondents who were not in the labor force at the time of survey, respectively, spent at least one day at the hospital bed for the purpose of medical treatment. This result may suggest reverse causation. That is, poor health may prevent individuals from holding regular employment, which in turn results in the higher rate of hospitalization among unemployed or not in labor force individuals. The latter finding would seem to distinguish countries like Korea which provide universal health coverage from countries where having health and hospitalization insurance is closely related to labor force status. Obviously, individuals with chronic or acute diseases are substantially more likely to be hospitalized than those with no diseases.

Table 8.2 shows descriptive statistics for PSU-level characteristics and their bivariate association with individual risk of hospitalization. None of the coefficients of macro-level SES characteristics included in this project (percent

Table 8.2. Descriptive Statistics for Area-Level Risk Factors and Correlation Coefficients for Each Risk Factors and Hospitalization Status

Risk Factors	Mean	(SD)	Rho
Level 2 (Primary Sampling Units, PSU)			
High Family Income Individuals (%)[1]	31.77	(17.08)	-0.01
College Graduated Population (%)[1]	25.23	(16.16)	-0.01
Average Official Residential Land Value (1,000 Won)[2]	830.26	(521.43)	0.02
# of Physicians per 1,000[3]	1.28	(1.42)	0.03**
Public Expenditure for Social Developement per Capita (1,000 Won)[3]	191.00	(149.65)	0.00
# of Pollution Generating Facilities per 1 Km^2[3]	13.01	(18.08)	0.00
Total Number of Level 2 Units	77		

**: p<0.01, *: p<0.05

Source: 1. Korea National Health and Nutrition Survey (1998)
2. Official Property and Land Value, Korea Association of Property Paaraisers (1999)
3. Annual Statistical Reports (1999)

high family income individuals, percent college graduated population, and average official residential purpose land value) is either significant or substantial in magnitude, indicating no association between area SES and individual risk of hospitalization. Moreover, coefficients of proxy variables for public support to promote public health and level of pollution in the area are essentially zero, suggesting absolutely no bivariate association between these macro-profiles and hospitalization in the area. The coefficient pertaining to relative number of physicians present has a positive sign and is significant, which also may indicate reverse causation. That is, it may be that physicians are more attracted to areas

where patients needing care are more common. However, it is also possible that individuals who need serious medical services that require hospital stays may have a tendency to reside in areas where they can access physicians (and hospital) more easily. Overall, the associations between most macro-level risk factors and individual risk of hospitalization, except the number of available physicians, are not different from zero, which suggests there is little or no effect of macro-variables in explaining variations in the utilization of health services among individuals across 77 PSUs.

2. MULTIVARIATE ANALYSES

A. Models with Individual-level Risk Factors Only

Selection of proper statistical techniques for multivariate analysis is dependent on the existence of area-level variances in predicting the dependent variable, as discussed in Chapter 4. To verify if significant variance is originated from level-2 units, I first ran a random effect multilevel analysis model for individual risk of hospitalization without including any covariates, which generated neither significant nor substantial estimate of random intercept variance from the level-2 units (0.039, p=0.07). This indicates that there is no substantial

variation in the level of hospitalization across 77 PSUs in Metropolitan Seoul area, and suggests no advantage of utilizing random effect multilevel analysis techniques for further multivariate analyses. Therefore, I utilize conventional logistic regression analysis to investigate the effects of individual- and PSU-level characteristics on the risk of hospitalization among Metropolitan Seoul adult residents.

Table 8.3 displays the results of logistic regression analysis for individual-level variables only. Model 1 includes basic demographic characteristics (age and sex) and disease status. As already noted, I include disease status in all regression models to control the risk of utilization of health services due to disease. As expected, individuals who have chronic or acute diseases have a very risk of hospitalization across all models. The coefficients for age have a sign that is negative and significant, suggesting that older age significantly lowers the risk of hospitalization, net of one's chronic or acute disease status. Note that age did not differentiate hospitalization status in the descriptive analysis in Table 8.1. Controls for sex and disease status better specifies the relationship between age and the risk of hospitalization. Compared to females, male residents of Metropolitan Seoul utilize health services significantly less frequently.

Model 2 adds number of family members and marital status. In this model, the advantage of age and being male in the risk of hospitalization remain

Table 8.3. Effects of Individual Risk Factors on Hospitalization Status Based on Logistic Regression Models for Metropolitan Seoul (ages 25 and over)

	Model 1		Model 2		Model 3		Model 4	
Fixed Effects	Coeffi.	SE	Coeffi.	SE	Coeffi.	SE	Coeffi.	SE
Individual Level								
Intercept	-2.584**	(0.153)	-2.164**	(0.217)	-2.993**	(0.197)	-2.514**	(0.264)
Disease [No]								
Yes	0.815**	(0.109)	0.789**	(0.109)	0.830**	(0.109)	0.802**	(0.110)
Age (cont)	-0.009**	(0.003)	-0.016**	(0.004)	-0.012**	(0.004)	-0.021**	(0.004)
Sex [Female]								
Male	-0.640**	(0.058)	-0.571**	(0.088)	-0.374**	(0.105)	-0.320**	(0.112)
# of Family Member (cont)			-0.015	(0.031)			-0.003	(0.033)
Marital Status [Married]								
Single			-0.674**	(0.170)			-0.778**	(0.179)
Widowed			0.313*	(0.159)			0.274	(0.170)
Divorced/Separated			-0.039	(0.277)			0.009	(0.284)
Education [Some College +]								
High School					0.042	(0.109)	0.000	(0.110)
Less than High Sch					-0.181	(0.137)	-0.220	(0.138)
Employment Status [Employed]								
Not in Labor Force					0.733**	(0.108)	0.697**	(0.113)
Unemployed					0.844**	(0.125)	0.933**	(0.133)
Subjective Social Status [High + Middle]								
Low					-0.149	(0.104)	-0.127	(0.091)
Family Income (High)								
Medium					0.159	(0.104)	0.140	(0.105)
Low					0.367**	(0.124)	0.401**	(0.133)
Missing					-0.094	(0.215)	-0.072	(0.220)
Deviance (-2LL)	4711.6		4691.0		4621.3		4597.2	

Note: Coeffi.: Coefficient, SE: Standard Error

*: P<0.05; **: P<0.01

For hospitalization status, 1: if ever hospitalized last year and 0: if not hospitalized

significant. Even after controls for age and disease status, singles are significantly less likely to utilize medical services than married individuals, while widowed persons are at significantly greater risk of hospitalization.

In Model 3, which includes the SES indicators and deletes the family/marital status variables, the likelihood of utilizing health services due to severe conditions for age and sex remains consistent with previous models, although the difference between males and females in the risk of hospitalization decreased compared to Model 1. Educational attainment and subjective social status do not show significant effects on the risk of hospitalization. But being unemployed or not in labor force strongly increases the risk, which again may be the result of reverse causation. Interestingly, low family income individuals are more likely to be hospitalized than their high family income counterparts. There could be two complementary explanations. First, it is probable that low income individuals are more likely to engage in occupations that have higher risk of accidents (e.g., construction or other heavy manual labor). Physical damage caused by accidents may require hospitalization, but such traumas are not considered as diseases. Therefore, individuals of low family income may have higher risk of hospitalization than their high family income counterparts. Second, hospitalization is more associated with severe health problems, as noted earlier. High income individuals in general may have protective health behaviors and

attitudes, compared to low income individuals (Lynch et at. 1996). Low income individuals, in contrast, may be prone to postpone seeking medical services when they have minor health problems (perhaps due to a greater necessity to stay "on the job"), which may develop into serious conditions that require hospital stays. Indeed, Cho et al. (2000) found that family income was strongly associated with increased risk of outpatient visits, as a proxy for utilization of health services for minor health problems.

Inclusion of all risks in the full model (Model 4) does not alter the pattern of association between each individual characteristic and the risk of hospitalization found in the previous models, except for the effect of being widowed that becomes non-significant and of being divorced/separated where the sign reverses. Another interesting finding from Table 8.3 is the effect of age on the risk of hospitalization. It was expected that the probability of hospital stay would increase as one becomes older. However, the coefficients of age across four models have negative signs. As mentioned earlier, this can be explained with respect to the nature of hospitalization. Hospitalization implies severe health conditions. It is obvious that age increases the risk of chronic diseases (see Chapter 6), and presence of chronic diseases apparently increase one's utilization of health services by outpatient visits, rather than hospital stays. Indeed, a recent study by Cho et al. (2000) found among Koreans that age significantly increased

the odds of seeking outpatient visits. Thus, young Koreans apparently tend to utilize health services more often for severe conditions that require hospital stays, while older Koreans have a tendency to utilize health services due to chronic conditions that require frequent outpatient visits. The latter results are substantively interesting and also have substantial policy implications.

B. Models Containing Both Individual- and Contextual-level Risk Factors

Table 8.4 shows the coefficients generated form conventional logistic regression models that include five ecological variables in addition to individual characteristics. As in previous chapters, area-level education is not included the analyses to prevent multicollinearity problem with area-level income. Descriptive statistics in Table 8.2 have already demonstrated that none of the area-level characteristics is associated with individual risk of hospitalization, except for the presence of physicians. Controlling for various individual-level profiles does not alter the associations between macro variables and the odds of hospitalization from Model 1 through Model 5. Moreover, the significance and magnitude of each individual-level risk factor remain largely unchanged, except for the effect of an individual's education. However, in Model 2 where percentage of high family income individuals is controlled, although the effect of this macro variable is not significant (with negative sign, suggesting the possibility that affluence of area

Table 8.4. Effects of Individual and Macro Risk Factors on Hospitalization Status Based on Logistic Regression Models for Metropolitan Seoul (ages 25 and over).

	Model 1		Model 2		Model 3		Model 4		Model 5		Model 6	
Fixed Effects	Coeffi.	SE	Coeffi.	SE	Coeffi.	SE	Coeffi.	SE	Coeffi.	SE	Coeffi.	SE
Individual Level												
Intercept	-2.608**	(0.276)	-2.322**	(0.285)	-2.623**	(0.267)	-2.549**	(0.267)	-2.522**	(0.265)	-2.386**	(0.317)
Disease [No]												
Yes	0.800**	(0.110)	0.800**	(0.110)	0.799**	(0.110)	0.802**	(0.110)	0.802**	(0.110)	0.797**	(0.110)
Age (cont)	-0.021**	(0.004)	-0.020**	(0.004)	-0.021**	(0.004)	-0.021**	(0.004)	-0.021**	(0.004)	-0.020**	(0.004)
Sex [Female]												
Male	-0.319**	(0.112)	-0.325**	(0.112)	-0.316**	(0.112)	-0.320**	(0.112)	-0.319**	(0.112)	-0.322**	(0.112)
# of Family Member (cont)	0.000	(0.034)	-0.001	(0.033)	0.002	(0.033)	-0.004	(0.033)	-0.004	(0.033)	0.007	(0.034)
Marital Status [Married]												
Single	-0.785**	(0.179)	-0.786**	(0.179)	-0.791**	(0.179)	-0.777**	(0.179)	-0.781**	(0.179)	-0.794**	(0.179)
Widowed	0.275	(0.170)	0.267	(0.170)	0.280	(0.170)	0.275	(0.170)	0.276	(0.170)	0.267	(0.170)
Divorced/Separated	0.000	(0.284)	0.011	(0.284)	-0.001	(0.284)	0.011	(0.284)	0.005	(0.110)	0.013	(0.284)
Education [Some College +]												
High School	0.010	(0.110)	-0.042	(0.113)	0.007	(0.110)	-0.003	(0.110)	0.001	(0.110)	-0.039	(0.113)
Less than High Sch	-0.204	(0.139)	-0.290*	(0.144)	-0.218	(0.138)	-0.231	(0.139)	-0.219	(0.138)	-0.292*	(0.144)
Employment Status [Employed]												
Not in Labor Force	0.691**	(0.113)	0.718**	(0.114)	0.703**	(0.113)	0.703**	(0.113)	0.698**	(0.113)	0.721**	(0.114)
Unemployed	0.928**	(0.133)	0.949**	(0.133)	0.930**	(0.133)	0.940**	(0.133)	0.933**	(0.133)	0.945**	(0.133)
Subjective Social Status [High + Middle]												
Low	-0.135	(0.091)	-0.143	(0.092)	-0.139	(0.091)	-0.121	(0.092)	-0.129	(0.091)	-0.155	(0.092)
Family Income (High)												
Medium	0.146	(0.106)	0.097	(0.108)	0.141	(0.105)	0.135	(0.106)	0.140	(0.105)	0.098	(0.108)
Low	0.417**	(0.134)	0.342*	(0.137)	0.413**	(0.133)	0.388**	(0.134)	0.400**	(0.133)	0.360**	(0.138)
Missing	-0.061	(0.220)	-0.116	(0.221)	-0.075	(0.220)	-0.082	(0.220)	-0.072	(0.220)	-0.122	(0.222)
Macro Level												
Land Value	0.000	(0.000)									-0.000	(0.000)
% High Family Income Individuals			-0.005	(0.003)							-0.005	(0.003)
# of Physicians per 1000					0.076**	(0.025)					0.100*	(0.042)
Public Expenditure for Social Development per capita							0.000	(0.000)			-0.000	(0.000)
# of Pollution Generating Facilities per Km^2									0.001	(0.002)	-0.003	(0.002)
Deviance (-2LL)	4595.8		4594.0		4589.0		4596.4		4596.9		4584.3	

Note: Coeffi.: Coefficient, SE: Standard Error

*: P<0.05; **: P<0.01

For hospitalization status, 1: if ever hospitalized last year and 0: if not hospitalized

decreases the risk of hospitalization), the coefficients for education substantially decreased over the model without macro variables (Model 4 in Table 8.3). In particular, individuals with less than a high school degree are significantly less likely to be hospitalized than their higher educated counterparts, once area-level family income is controlled. The low education effect is also significant in the full model (Model 6 of Table 8.4). The only macro-level variable that significantly affects the individual risk of hospitalization, net of individual risk factors, is the number of physicians per 1,000 residents. The positive coefficient suggests, as already indicated, that physicians may locate where there are more individual who require hospitalization. It is also possible that individuals who need to utilize medical services tend to reside where they have better access to physicians in terms of physical distance.

3. SUMMARY

The purposes of this chapter were to identify which, and to what extent, individual- and area-level characteristics have effects on individual risk of hospitalization, as a proxy of utilization of health services for severe health problems, and to investigate whether or not variation in hospitalization status

exists across 77 PSUs exist in Metropolitan Seoul. In the descriptive analysis, sex and employment status were the only individual-level characteristics that showed a strong association with the risk of hospitalization. Among macro-level variables, physician presence was the only factor that had a significant association with the risk of hospitalization. However, multivariate logistic regression models which controlled for disease status showed that sex, employment status, age, marital status (single), and family income (low income individuals) had significant effects on the risk of hospitalizations. Of particular interest were the effects of age and low family income such that their pattern of association with the utilization of hospital beds was different from general expectations. That is, older age lowers the probability of hospitalization, while low income increases the risk. These two findings may be explained in terms of the pattern of outpatient visits, as I already discussed. None of the effects of contextual variables, except the number of physicians present per 1,000 residents, came out to be significant on the individual risk of hospitalization, net of all individual risk factors. Random effect multilevel analysis generated non-significant random intercept variance. This means that the level of hospitalization does not vary across 77 PSUs. Moreover, non-significant contextual variables implied no advantage of further investigation for cross-level interaction effects.

CHAPTER 9: CONCLUSION

I began this dissertation by introducing recent changes in the urbanization pattern observed in Seoul, Korea, and its periphery, although the larger agenda of this project was to study the contemporary health of Metropolitan Seoul residents from a sociological point of view. The reason for this was that the recent process of urbanization in Metropolitan Seoul included the geographic redistribution of residents by SES, which, in turn, can be assumed to be followed by uneven distributions of social resources and the quality of life. A number of previous studies (mostly from Western societies) (e.g., Lee and Cubbin 2002; Haan, Kaplan, and Camacho 1987; Sooman and Macintyre 1995; Diez-Roux et al. 1997; Yen and Kaplan 1998; Ross 2000; Balfour and Kaplan 2002) suggest that the local environment may be influential on mortality, morbidity, and health behaviors of individuals. Given the recent process of residential clustering in Metropolitan Seoul according to SES, it was expected that unevenly distributed social resources and quality of life across small areas would have effects on the health and health behaviors of individuals, net of individual characteristics.

Specifically, this dissertation had three aims: (1) to document the effects of individual-level sociodemographic and/or SES characteristics on health; (2) to

investigate which, and to what extent, contextual-level attributes have an impact on the health of individuals; and (3) to detect geographic variations in health across small-areas in Metropolitan Seoul. Here, I address the most relevant to each of three objectives by drawing on findings presented in Chapter 5 through Chapter 8.

The Effects of Individual-Level Characteristics on the Health of Metropolitan Seoul Adult Residents

As briefly mentioned in introduction, there have been few studies that have investigated the health of Koreans from sociological and/or social epidemiological points of view. Therefore, my selection of individual-level characteristics was based on studies of this sort conducted in Western societies. Two categories of individual characteristics were included in the analyses as risk factors for adverse health outcomes: demographic characteristics (i.e., age, sex, family size, and marital status) and socioeconomic status (i.e., educational attainment, employment status, self-assessed social status, and family income).

In the case of demographic characteristics, age significantly increased the probability of activity limitations, chronic diseases, and poor self-rating of health status. However, systematic relationships were not observed between other demographic characteristics and the three health outcomes. For instance, males

were significantly less likely to assess their health as poor than were females, but there was no significant advantage of males with respect to activity limitations. Further, having more family members was advantageous in lowering the risk of chronic diseases, while it was not significantly related to the other two health outcomes. In general, being married is believed to be advantageous for health, adjusted for other risk factors. This relationship has been found among adult Americans (Rogers et al. 2000) and immigrants (Hummer et al.2000; Frisbie et al. 2001). However, among Koreans, the advantage of being married over other marital statuses was found only in the case of activity limitations.

Indicators of individual-level SES followed a predictable pattern of association with health outcome variables. That is, high SES played a substantially protective role, which is consistent with findings from previous studies (Adler and Ostrove 1999; Kitagawa and Hauser 1973; House et al., 1990). In particular, the effect of educational attainment on adverse health outcomes was substantial, but not surprising given the importance of education in Korean society. While family income had little impact on the risk of chronic diseases, those who had less than a high school education were much higher risk of severe and moderate chronic diseases than those who had a college education (see Table 6.3). Among Metropolitan Seoul residents, positive assessment of one's own

social status had a substantially protective effect on health outcomes, net of controls.

To summarize, overall, the individual-level demographic and SES differences are related to variation in health among individuals in Metropolitan Seoul. Health of individuals was notably affected by differences in educational attainment and subjective social status, while the effects of family income and employment status were less important. Moreover, bivariate relationship between each SES variables and each health outcome did not change in pattern or magnitude in multivariate models, while notable changes were found in the relationship between demographic factors and health outcomes.

The Effects of Context (PSUs) on the Health of Individuals

Contextual effects were expected to have an impact on individual health because recent intra-urban population redistribution in Metropolitan Seoul was accompanied by unevenness in the distribution of social resources and quality of life, which, in turn, might be expected to have influence on the health of individuals. Thus, my review of literature in Chapter 2 was heavily weighted by previous discussions on the role of contextual characteristics in shaping health of individuals as well as geographic unequal distribution of health. I included three types of contextual variables in the analysis: area level SES, public/organizational

aspects, and environmental aspects. Although bivariate correlation coefficients (Table 5.2, 6.2, and 7.2) suggested several significant associations of area-level SES (measured by percentage of high family income individuals, percentage of the population with a college education, and average official residential land values) and public/organizational aspects (measured by the number of physicians per thousand and public expenditures for social development per capita) with three adverse health outcomes, these relationships vanished in the multivariate analyses that simultaneously controlled individual-level characteristics. The proxy measure of environmental condition (the number of pollution generating facilities per one square kilometers) had no significant effect in either bivatiate or multivariate analyses. Furthermore, inclusion of contextual variables in the multivariate models did not alter the significance or the magnitude of effects of individual risk factors on the health of Metropolitan Seoul adult residents.

The lack of significant contextual effects seems to contradict previous studies that emphasized the role of area characteristics in shaping individual health outcomes (e.g., Humphreys and Carr-Hill 1991; Langford and Bentham 1996). However, it is premature to conclude that contextual effects on the health of Korean are substantively inconsequential. First, it was perhaps unlikely at the outset that characteristics of current area of residence would have anything other than a minor effect on health outcomes. For instance, activity limitations may be

produced by a wide range of events and conditions. Some activity limitations may be the result of accidental injuries. Others may result from disease, either chronic or acute. Further, this project encounters the same limitation that attaches to all studies in which individual health and contextual variables are measured contemporaneously. Chronic conditions, as well as activity limitations and negative self-rating of health status, are often incurred in places and time periods far removed from current circumstances. This problem is likely exacerbated in Metropolitan Seoul – an area in which considerable population redistribution has occurred in recent years according to patterns not seen in previous time periods. Put simply, many individuals may not have resided in areas where they were surveyed long enough for health to be affected one way or the other. Indeed, Waitzman and Smith (1998) suggest that contextual influences on individual health may become apparent only after a person has been exposed to those influences for a substantial period of time. Thus, residential duration may be extremely important in investigating the relationship between ecological conditions and health of individuals. Moreover, a number of recent studies from Western societies have also reported little influence of context on the health of individuals after controls for individual differences (e.g., Sloggett and Joshi 1994; Robert 1999; Yen and Syme 1999). In retrospect, it is not surprising that health

outcomes are more dependent on individual-level characteristics rather than contextual variables in Metropolitan Seoul.

The Relationship between Individual-Level Risk Factors and Area-Level Risk Factors with Regard to Their Effects on Individual Health Outcomes.

Certain studies report significant effects of macro-level variables on the health of individuals independent of the effects of individual-level characteristics (e.g., Duncan, Jones, and Moon 1998; Diez-Roux 2000). Diez-Roux (2002: 516) comments that "the persistence of an independent area effect would suggest that things about the area itself are important to the health of its residents." In this project, however, none of contextual risk factors came out to be significantly effective on three health outcome variables, and as a result, inclusion of contextual variables in multivariate models did not alter the magnitude, the significance, or the pattern of associations of individuals-level risk factors. Non-significance of contextual effect also suggested no need of including cross-level interaction terms in the models.

Variations in Health across Small Areas in Metropolitan Seoul

The methodological advantage of using random effect multilevel analysis techniques is that it allows decomposition of error variance. In this dissertation, I

found significant error variance generated from the level-2 unit (the PSUs) in the cases of activity limitations and chronic disease status, while no significant value of PSU-level variance was found for self-rated health status. Further, progressive inclusion of individual- and area-level covariates did not reduce the significance and magnitude of level-2 variance to any notable degree. This suggests that there exists variation in the levels of activity limitations and chronic disease across small areas in Metropolitan Seoul, although no areal variation was found for self-rated health status. Given the fact that activity limitations and chronic disease status are more objective measures of general health, significant geographic differences in these two health outcomes points to sociological implications for the recent pattern of urbanization in Korea.

As already addressed in the introductory section, Korea has paid particular attention to the uneven distribution of health and health services between urban and rural areas. Findings from this project suggest that, with the recent intra-urban redistribution of population by SES, intra-urban geographic differences in health has begun to take place in Metropolitan Seoul. Moreover, the fact that macro-level measures do not appear to be related to the uneven distribution of health and illness within Metropolitan Seoul indicates the need of further research (with more appropriate data, including duration of residence) in elucidating the complexity of intra-urban distribution of health and illness. This task should

involve qualitative, as well as quantitative, investigation of areas in Metropolitan Seoul: investigations that might uncover contextual characteristics unique to Korean society, but which are not measurable with data sets employed in this project. To illustrate, one factor, not specified in this study, that might create significant variations in activity limitations and chronic illness across PSUs in Metropolitan Seoul is the cultural dimension of context.

Utilization of Health Services

Utilization of health services is of particular interest to public health providers, since timely utilization of health care services is one of the important factors in preventing and curing disease. In Chapter 8, I employed annual hospitalization as a proxy measure of utilization of health services for severe health problems. Since Korea has a universal health insurance system, and I controlled for whether or not one has a chronic or acute disease in the analysis, hospitalization status should adequately capture the dimension for utilization of health care services rather than access to care or physical conditions (note that I included one's disease status as a control throughout models in Chapter 8). However, neither significant effects of contextual variables nor significant variations in utilization of hospitalization services across small areas was found.

Since hospitalization typically occurs only in cases of severe health problems, it was necessary to take into account outpatient visits simultaneously as a proxy measure of utilization of health services due to less severe conditions. As I addressed in Chapter 8, based on the findings from this dissertation and a recent study by Cho et al. (2000), the pattern of utilizing health services among Koreans is notably different by a person's age and family income. That is, the elderly are less likely to utilize hospitalization service but more likely to use outpatient care. Individuals of low family income, as compared to their high family income counterparts, are less likely to utilize outpatient visits but more likely to be hospitalized. These two patterns are important for informing public health policy.

As discussed in Chapter 5 and 6, age substantially increases one's risk of activity limitations, and both moderate and severe chronic diseases. Given this, it is probable that individuals in Metropolitan Seoul would need medical services not only through outpatient visits but also through hospitalization, as they become aged. However, findings in Chapter 8 showed a different pattern of utilization of health services among elderly populations in that they were prone to under-utilize hospital services, net of other individual conditions. Perhaps elderly Koreans, even though ill, are not inclined to use health care services because they consider chronic illness to be a natural condition in the life cycle. Indeed, over 20% of all deaths among elderly Korean population (age 65 and over) were recorded as due

to unknown causes in 1998, while the figure is less than 1% for their Korean American counterparts (Cho, Ahn, and Jung 2001). One implication is that public health policy should be prepared to promote the use of health care services for severe illness among elderly population in Metropolitan Seoul.

Second, individuals of low family income are also in need of further study in light of their pattern of health service utilization. The fact that these individuals are less likely to utilize outpatient visits, but more likely to utilize hospitalization, compared to their high family income counterparts, may indicate that they have a tendency to seek medical services for curative purposes rather than preventive purposes. Given the higher cost of medical services for cure than that for prevention, individuals of low family income in Metropolitan Seoul face a situation where that they have to spend more for medical expenses, because certain medical services (e.g., Magnetic Resonance Imaging) for severe diseases are often not covered by national health insurance. In other words, low SES individuals suffer from a higher risk of health problems, and they also have limited resources to pay for medical expenses not covered by insurance. Therefore, government public policy should focus how to improve the access of low income individuals to utilize preventive health services.

This research contributes in more than a minor way to our knowledge of inequalities in health status. First, as indicated earlier, it represents one of the few attempts to examine the health of individuals in Metropolitan Seoul from a sociological point of view, taking into account the influence of both individual and ecological risk factors simultaneously. Most health related research in Korea has been carried out along the lines of a simple urban-rural dichotomy, and little information has been available on the extent to which social risk factors are associated with intra-urban variation in the health status of Koreans. The findings of this project clearly indicated that low SES significantly increases one's probability of adverse health outcomes and inadequate utilization of health services for Metropolitan Seoul adult residents. In particular, individuals of very low educational attainment are substantially disadvantaged in health outcomes, compared to more highly educated individuals. Given the importance of education in Korean society as a major determinant of social status, these findings suggest that more attention needs to be paid, and public health resources allocated to, the low-SES population of Korea who reside in the relatively well-developed metropolitan Seoul area. Furthermore, public health policy should be focused on promoting adequate health care utilization for prevention of disease and illness among this population, in addition to emphasizing equal access.

Further, this project is one of the few studies that attempts to investigate the health of individuals outside of Western societies, taking into consideration the effects of both individual- and contextual-level characteristics and employing the random effect multilevel analysis technique. Although contextual variables, as measured here, had little impact on the health outcomes of individuals in Metropolitan Seoul, this study uncovered intra-urban inequalities in the distribution of health and illness across small areas, at least in terms of more objective measures of adverse health outcome (activity limitations and chronic disease status). Inclusion of both individual and contextual risk factors in the analysis did not fully account for the variations in health outcomes across 77 PSUs. As already discussed, future research should attempt to specify the type of individual- and contextual-level variables unique to situations in Metropolitan Seoul and Korean society. Finally, data sets constructed specifically to facilitate multilevel analysis may well lead to the discovery of important contextual effects on individual health.

Bibliography

Aber, J. Lawrence, Martha A. Gephart, Jeanne Brooks-Gunn, and James P. Connell. 1997. "Development in Context: Implications for Studying Neighborhood Effects." in Jeanne Brooks-Gunn, Greg J. Duncan, and J. Lawrence Aber (eds.) *Neighborhood Poverty: (Volume I) Context and Consequences for Children*. New York: Russell Sage Foundation.

Adler, N. E., and J. M. Ostrove. 1999. "Socioeconomic Status and Health: What We Know and We Don't." *Annals of the New York Academy of Sciences* 896-3-15.

Alker, H. S. 1969. "A Typology of Ecological Fallacies." in Dogan, M. and S. Rokkan (Eds.), *Quantitative Ecological Analysis*, Massachusetts: MIT Press.

Angel, Ronald, and Peter J. Guarnaccia. 1989. "Mind, Body, and Culture: Somatization Among Hispanics." *Social Science and Medicine* 23: 1229-1238.

Balfour, Jennifer L., and George A. Kaplan. 2001. "Neighborhood Environment and Loss of Physical Function in Older Adults: Evidence from the Alameda County Study. " *American Journal of Epidemiology* 155: 507-515.

Banks, Steven M., and John A. Pandiani. 1998. "The Use of State and General Hospitals for Inpatient Psychiatric Care." *American Journal of Public Health* 88: 448-451.

Bergmann, Manuela M., Tim Byers, David S. Feedman, and Ali Mokdad. 1998. "Validity of Self-reported Diagnoses Leading to Hospitalization: A Comparison of Self-reports with Hospital Records in a Prospective Study of American Adults." *American Journal of Epidemiology* 147: 969-977.

Bolye, Michael H., and J. Douglas Willms. 1999. "Place Effects for Areas Defined by Administrative Boundaries." *American Journal of Epidemiology* 149: 577-585.

Bosma, Hans, H. Dike van de Mheen, Gerard J. J. M. Borsboom, and Johan P. Mackenbach. 2001. "Neighborhood Socioeconomic Status and All-Cause Mortality." *American Journal of Epidemiology* 153: 363-371.

Bourdieu, Pierre. 1984. *Disillusion: A Social Critique of the Judgment of Taste*. London: Routledge.

Bryk, Anthony S., and Stephen W. Raudenbush. 1992. *Hierarchical Linear Models*. Sage Publication: California.

Bryk, Anthony S., Stephen W. Raudenbush, M. Seltzer, and R. Congdon. 1988. *An Introduction to HLM: Computer Program and User's Guide (2nd ed.)*. Chicago: University of Chicago Department of Education.

Cho, Youngtae, Hyong-sik Ahn, and Sung Won Jung. 2001. "Migration and Health: A Comparative Study of Korean Americans and Koreans' Mortality Profiles." *Korea Journal of Population Studies* 24(2).

Cho, Youngtae, W. Parker Frisbie, and Jungja Nam. 2000. “Comparison of Health Status between Koreans and Korean Americans.” in *A Thorough Study on the Korea Health and Nutrition Survey, 1998*. Korea Institute for Health and Social Affairs, Ministry of Health and Welfare, Republic of Korea.

Cho, Youngtae, W. Parker Frisbie, Robert A. Hummer, and Richard G. Rogers. “Immigration, Duration of Residence, and the Health of Hispanic Adults in the United States.” *International Migration Review* (forthcoming).

Cho, Youngtae. 1999. *The Urbanization Process in Metropolitan Seoul: An Ecological Point of View*. Unpublished Master's Thesis. The University of Texas at Austin.

Choi, Jin-Ho. 1994. “Internal Migration of Korea and Population Movement into the Capital Region.” *Korea Journal of Population Studies* 12: 1-20.

Choi, Jin-Ho. 1997. “Changes in the Pattern of Population Movement: 1960-1990.” In Population Association of Korea (eds.), *Population Dynamics and Quality of Life*. Seoul: Ilshinsa.

Clarke, L. L., F. Farmer and M. K. Miller. 1994. "Structural Determinants of Infant Mortality in Metropolitan and Nonmetropolitan America." *Rural Sociology* 59: 84-99.

Curtis, Sarah, and Ian Rees Jones. 1998. “Is There a Place for Geography in the Analysis of Health Inequality?” *Sociology of Health & Illness* 20: 645-672.

Danziger, Sheldon. 1996. “Comment on ‘The Age of Extremes: Concentrated Affluence and Poverty in the Twenty-First Century.’” *Demography* 33: 413-416.

Diez-Roux, Ana V. 1998. "Bringing Context Back into Epidemiology: Variables and Fallacies in Multilevel Analysis." *American Journal of Public Health* 88: 216-222.

Diez-Roux, Ana V. 2000. “Multilevel Analysis in Public Health Research.” *Annual Review of Public Health* 21: 171-192.

Diez-Roux, Ana V. 2001. “Investigating Neighborhood and Area Effects on Health.” *American Journal of Public Health* 91: 1783-1789.

Diez-Roux, Ana V. 2002. "Invited Commentary: Place, People, and Health." American Journal of Public Health 155: 516-519.

Diez-Roux, Ana V., F. J. Nieto, C. Muntaner, H. A. Tyroler, G. W. Comstock, E. Shahar, R. L. Watson, and M. Szklo. 1997. "Neighborhood Environments and Coronary Heart Disease: A Multilevel Analysis." American Journal of Epidemiology 146: 48-63.

DiPrete, Thomas A., and Jerry D. Forristal. 1994. “Multilevel Models: Methods and Substance.” *Annual Review of Sociology* 20: 331-357.

Duncan, Craig, Kelvyn Jones, and Graham Moon. 1993. “Do Place Matter? A Multi-level Analysis of Regional Variation in Health Related Behavior in Britain.” *Social Science and Medicine* 37: 725-733.

Duncan, Craig, Kelvyn Jones, and Graham Moon. 1996. "Health-Related Behavior in Context: A Multilevel Modeling Approach." *Social Science and Medicine* 42: 817-830.

Duncan, Craig, Kelvyn Jones, and Graham Moon. 1998. "Context, Composition, and Heterogeneity: Using Multilevel Models in Health Research." *Social Science and Medicine* 46: 97-117.

Duncan, Craig, Kelvyn Jones, and Graham Moon. 1999. "Smoking and Deprivation: Are There Neighborhood Effects?" *Social Science and Medicine* 48: 497-505.

Durkheim, Emile. 1897/1964. *Suicide*. Glencoe, Illinois: Free Press.

Echevarria, Samuel, and W. Parker Frisbie. 2001. "Face/Ethnic-Specific Variation in Adequacy of Prenatal Care Utilization." *Social Forces* 80: 633-655.

Fang, Jing, Shantha Madhavan, William Bosworth, and Michael H. Alderman. 1998. "Residential Segregation and Mortality in New York City." *Social Science and Medicine* 47: 469-476.

Farley, Reynolds. 1996. "The Age of Extremes: A Revisionist Perspective." *Demography* 33: 417-420.

Ferraro, Kenneth F., and Melissa M. Farmer. 1999. "Utility of Health Data from Social Surveys: Is There a Gold Standard for Measuring Morbidity?" *American Sociological Review* 64: 303-315.

Finch, Brian Karl, William A. Vega, and Bohdan Kolody. 2001. "Substance Use During Pregnancy in the State of California, USA." *Social Science and Medicine* 52: 571-583.

Fossett, Mark A., and Cynthia M. Cready. 1998. "Ecological Approaches in the Study of Racial and Ethnic Differentiation and Inequality." In M. Micklin and D. L. Poston, Jr. (eds.) *Continuities in Sociological Human Ecology*. New York: Plenum Press.

Frisbie, W. Parker, Youngtae Cho, and Robert A. Hummer. 2001. "Immigration and the Health of Asian and Pacific Islander Adults in the U.S." *American Journal of Epidemiology* 153: 372-380.

Frohlich, Katherine L., Ellen Corin, and Louise Potvin. 2001. "A Theoretical Proposal for the Relationship between Context and Disease." *Sociology of Health & Illness* 23: 776-797.

Geronimus, Arline T., John Bound, Timothy A. Waidmann, Cynthia G. Colen, and Dianne Steffick. 2001. "Inequality in Life Expectancy, Functional Status, and Active Life Expectancy Across Selected Black and White Populations in the United States." *Demography* 38: 227-251.

Giddens, Anthony. 1984. *The Constitution of Society*. Cambridge: Polity Press.

Goldstein, Harvey. 1995. *Multilevel Statistical Models*, Second Edition. London: Edward Arnold.

Guo, Guang, and Hongxin Zhao. 2000. "Multilevel Modeling for Binary Data." *Annual Review of Sociology* 26: 441-462.

Haan, Mary, George A. Kaplan, and Terry Camacho. 1987. "Poverty and Health: Prospective Evidence from the Alameda County Study." *American Journal of Epidemiology* 125: 989-998.

Hadley, J. 1982. *More Medical Care, Better Health?* Washington, DC: The Urban Institute Press.

Hart, Carol, Russell Ecob, and George D. Smith. 1997. "People, Place and Coronary Heart Disease Risk Factors: A Multilevel Analysis of the Scottish Heart Health Study Archive." *Social Science and Medicine* 45: 893-902.

Hawley, Amos H. 1971. *Urban Society: An Ecological Approach*. New York: The Ronald Press Company.

Hayward, R.A., A. M. Bernard, H. E. Freeman, and C.R. Corey. 1991. "Regular Source of Ambulatory Care and Access to Health Services." *American Journal of Public Health* 81: 434-438.

House, J.S., R. C. Kessler, and A. R. 1990. "Age, Socioeconomic Status, and Health." *Milbank Quarterly* 68: 383-411.

Hout, Michael, Richard Arum, and Kim Voss. 1996. "The Political Economy of Inequality in the 'Age of Extremes'" *Demography* 33: 421-425.

Hummer, Robert A., Ricard G. Rogers, Sarit H. Amir, Douglas Forbes, and W. Parker Frisbie. 2000. “Adult Mortality Differentials among Hispanic Subgroups and Non-Hispanic Whites.” *Social Science Quarterly* 81: 459-476.

Humphreys, Keith, and Roy Carr-Hill. 1991. “Area Variations in Health Outcomes: Artifact or Ecology.” *International Journal of Epidemiology* 20: 251-258.

Idler and Benyamini. 1997. “Self-rated Health and Mortality: A Review of Twenty-Seven community Studies.” *Journal of Health and Social Behavior* 38: 21-37.

Jenny, Alisa M., Kenneth C. Schoendorf, and Jennifer D. Parker. 2001. “The Association Between Community Context and Mortality Among Mexican-American Infants.” *Ethnicity and Disease* 11: 721-731.

Jones, Kelvyn, and Craig Duncan. 1995. "Individuals and Their Ecologies: Analyzing the Geography of Chronic Illness within a Multilevel Modeling Framework." *Health and Place* 1: 27-40.

Joo, Kyungshik, Hanjoong Kim, Sunhee Lee, and Hyeyoung Min. 1996. "A Comparative Study on Medical Utilization between Urban and Rural Korea." *Korean Journal of Preventive Medicine* 29: 311-329.

Kang, Hea-Young, and Yoo-Sun Shin. 1996. "A Comparative Study on the Health Status of Urban and Rural Elderly in Southeastern and Southwestern Area of Korea." *Chonnam Jouranl of Nursing Sciences* 1: 105-123.

Karvonen, Sakari, and Arja Rimpelä. 1996. “Socio-Regional Context as a Determinant of Adolescents’ health Behavior in Finland.” *Social Science and Medicine* 43: 1467-1474.

Kim, Jin-Soon. 1991. "Analysis of Utilization and Expenses of Medical Care Services in a Designated Rural Areas." *Korean Jouranl of Rural Medicine* 16: 125-133.

Kim, Young-Jung. 1994. “Problems of Uneven Regional Development.” In Hee-sub Lim and Gil-Sung Park (eds.), *Korean Society Today*. Seoul: Nanam Publishing House.

Kitagawa, E. M., and P. M. Hauser. 1973. *Differential Mortality in the United States: A Study in Socioeconomic Epidemiology*. Cambridge: Harvard University Press.

Korea Institute for Health and Social Affairs. 2000. *A Thorough Study on the Korea Health and Nutrition Survey, 1998*. Ministry of Health and Welfare, Republic of Korea.

Korea Urban Administration Research Center. 2001. *Annual Statistics of Korea*. Seoul: Aram Culture Publishing.

Korean Association of Property Appraisers. 2000. *’99 Official Land Values* (CD-rom).

Kreft, Ita, and Jan De Leeuw. 1998. *Introducing Multilevel Modeling*. London: Sage Publication.

Kuo, JoAnn, and Kathryn Porter. 1998. “Health Status of Asian Americans: United States, 1992-94.” *Advance Data, NCHS.* 298(August).

Kwon, Tae-hwan, Tae-hun Kim, and Jin-ho Choi. 1995. *Population and Family in Korea. Seoul*: Ilshinsa.

Langford, Ian H., and Graham Bentham. 1996. "Regional Variations in Mortality Rates in England and Wales: An Analysis Using Multi-level Modeling." *Social Science and Medicine* 42: 897-908.

LeClere, Felicia B., Richard G. Rogers, and Kimberley Peters. 1998. “Neighborhood Social Context and Racial Differences in Women’s Heart Disease Mortality.” *Journal of Health and Social Behavior* 39: 91-107.

Lee, Choong Ryeol, Cheol In Yoo, Jo Ho Lee, Yangho Kim. 2000. "Respiratory Health of the Children Living near the Petrochemical Estate in Ulsan." *Korean Jouranl of Preventive Medicine* 33: 174-183.

Lee, Chung Yul, Il Young Yoo, and Young Sook Chung. 1997. "A comparison of Health Status between Urban and Rural Elementary Students in Korea." *Journal of the Korean Society Maternal and Child Health* 1: 97-105.

Lee, Rebecca E., and Catherine Cubbin. 2002. "Neighborhood Context and Youth Cardiovascular Health Behaviors." *American Journal of Public Health* 92: 428-436.

Livneh, Hanoch, and Richard F. Antonak. 1997. *Psychosocial Adaptation to Chronic Illness and Disability*. Maryland: Aspen Publishers, Inc.

Lubkin, Ilene Morof. 1986. *Chronic Illness: Impact and Interventions*. Boston: Jones and Varlett Publishers, Inc.

Lynch, J. W., George. A. Kaplan, R. Cohen., J. Tuomilehto, and J. T. Salonen. 1996. "Do cardiovascular risk factors explain the relation between socioeconomic status, risk of all-cause mortality, cardiovascular mortality, and acute myocardial infarction?" *American Journal of Epidemiology* 144: 934-942.

Macintyre, Sally, Sheila Maciver, and Anne Sooman. 1993. "Area, Class and Health: Should We Be Focusing on Places or People?" *Journal of Social Policy* 22: 213-234.

Malmström, Marianne, Jan Sundquist, and Sven-Erik Johansson. 1999. "Neighborhood Environment and Self-Reported Health Status: A Multilevel Analysis." *American Journal of Public Health* 89: 1181-1186.

Massey, Douglas S. 1996. "The Age of Extremes: Concentrated Affluence and Poverty in the Twenty-First Century." *Demography* 33: 395-412.

Massey, Douglas S., and Mitchell L. Eggers. 1990. “The Ecology of Inequality: Minorities and the Concentration of Poverty, 1970-1980.” *American Journal of Sociology* 95: 1153-1189.

McGee, Daniel L., Youlian Liao, Guichan Cao, and Richard S. Cooper. 1999. “Self-reported Health Status and Mortality in a Multiethnic US Cohort.” *American Journal of Epidemiology* 149: 41-46.

Micklin, Michael, and David F. Sly. 1998. “The Ecological Complex: A Conceptual Elaboration.” In Micklin and Poston, Jr (eds.) *Continuities in Sociological Human Ecology*. New York: Plenum Press.

Min, Hye-Young, and Hyohn-Joo Oh. 1999. "A Comparison of Health Behavior between rural and Urban in Soonchun city." *Korean Journal of Rural Medicine* 24: 49-63.

Ministry of Health and Welfare. 1999. *The National Health and Nutrition Survey, 1998: Health Interview Survey*. Republic of Korea.

Mossey, Jana M., and Evelyn Shapiro. 1982. “Self-Rated Health: A Predictor of Mortality Among the Elderly.” *American Journal of Public Health* 72: 800-808.

Muramatsu, Naoko and Richard T. Campbell. 2002. “State Expenditures on Home and Community Based Services and Use of Formal and Informal Personal Assistance: A Multilevel Study.” *Journal of Health & Social Behavior* 43: 107-124.

Nam, Jeong-Ja, Maengjae Cho, and Eun Jin Choi. 1996. *Analysis on the Risk Factors of the Korean Health Status*. Korea Institute of Health and Social Affairs.

National Health Insurance Corporation. Korea. http://www.nhic.or.kr/jaryo/jarow.htm.

National Statistical Office, Korea. 1999. *Annual Report on the Cause of Death Statistics* (Based on Vital Registration).

National Statistical Office. Korea. http://www.nso.go.kr/cgi-bin/sws_999.cgi?ID=DT_1INOO01&IDTYPE=3&A_LANG=1&FPUB=3&SELITEM=0

Oh, Youngho. 1999. "An Econometric Analysis of the Difference between Outpatient Health Services in Urban and Rural Areas." *Health and Social Welfare Review* 19: 103-121.

Raudenbush, S. W., and A. S. Bryk. 1986. "A Hierarchical Model for Studying School Effects." *Sociology of Education* 59: 1-17.

Porell, Frank W., and Helen B. Miltiades. 2001. "Regional Differences in Functional Status Among The Aged." *Social Science and Medicine* 54: 1191-1198.

Rhoades, J., and M. Chu. 2000. *Health Insurance Status of the Civilian Noninstitutionalized Population: 1999*. Rockville: Agency for Healthcare Research and Quality.

Robert, Stephanie A. 1999. “Socioeconomic Position and Health: The Independent Contribution of Community Socioeconomic Context.” *Annual Review of Sociology* 25: 489-516.

Robinson, W. S. 1950. "Ecological Correlations and the Behavior of Individuals." *Sociological Review* 15: 351-357.

Rogers, Richard G. 1995. “Sociodemographic Characteristics of Long-Lived and Healthy Individuals.” *Population and Development Review* 21: 33-58.

Rogers, Richard G., Robert A. Hummer, and Charles B. Nam. 2000. *Living and Dying in the USA: Behavioral, Health, and Social Differentials of Adult Mortality.* California: Academic Press.

Ross, Catherine E. 2000. "Walking, Exercising, and Smoking: Does Neighborhood Matter?" Social Science and Medicine 51: 265-274.

Sloggett, A., and H. Joshi. 1994. “Higher Mortality in Deprived Areas: Community or Personal Disadvantage.” *British Medical Journal* 109: 1470-1474.

Snijders, Tom, and Roel Bosker. 1999. *Multilevel Analysis*. London: Sage Publication.

Sooman, Anne, and Sally Macintyre. 1995. "Health and Perceptions of the Local Environment in Socially Contrasting Neighborhoods in Glasgow." *Health and Place* 1:15-26.

Susser, Mervyn. 1994. "The Logic in Ecological: I. The Logic of Analysis." *American Jouranl of Public Health* 84: 825-829.

Verbrugge, L. M. 1989. "The Twain Meet: Empirical Explanations of Sex Differences in Health and Mortality." *Journal of Health and Social Behavior* 30: 282-304.

Waitzman, Norman J., and Ken R. Smith. 1998. "Phantom of the Area: Poverty-Area Residence and Mortality in the United States." *American Journal of Public Health* 88: 973-976.

Williams, David R., and Chiquita Collins. 1995. "U.S. Socioeconomic and Racial Differences in Health: Patterns and Explanations." *Annual Review of Sociology* 21: 349-386.

Wong, Geroge Y., and William M. Mason. 1985. "The Hierarchical Logistic Regression Model for Multilevel Analysis." *Journal of American Statistical Association* 80: 513-524.

Yen, Irene. H., and S. L. Syme. 1999. "The Social Environment and Health: A Discussion of the Epidemiologic Literature." *Annual Review of Public Health* 20: 287-308.

Yen, Irene H. and George A Kaplan. 1999. "Neighborhood Social Environment and Risk of Death: Multilevel Evidence from the Alameda County Study." *American Journal of Epidemiology* 149: 898-907.

Yen, Irene H., and George A. Kaplan. 1998. "Poverty Area Residence and Changes in Physical Activity Level: Evidence From the Alameda County Study." *American Journal of Public Health* 88: 1709-1712.

Yoon, In-Jin. 1998. “The Formation of Residential Division by Social Class in Seoul and Its Social Implication.” *Seoul Studies Journal* 10: 229-270.

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